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NATIONAL DAM INSPECTION PROGRAM. BIG PINEY RUN DAM (INVENTORY N--ETC(U)
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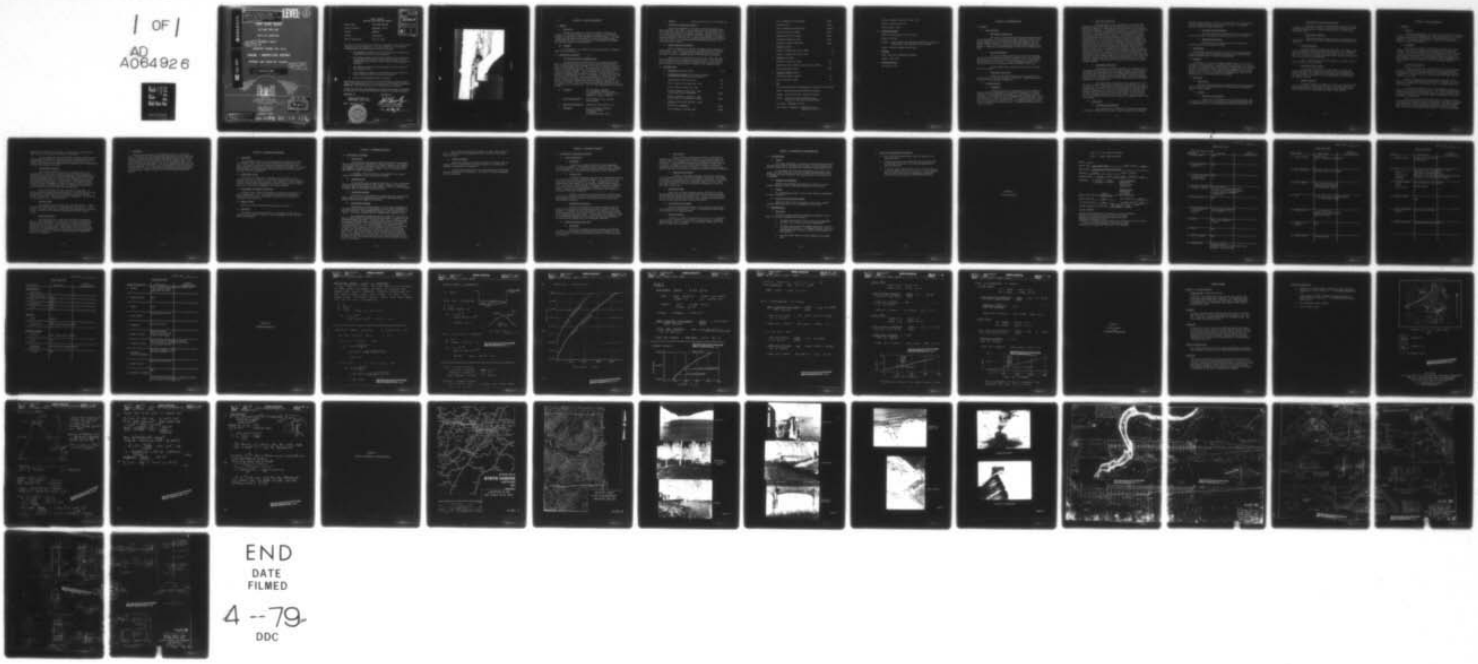

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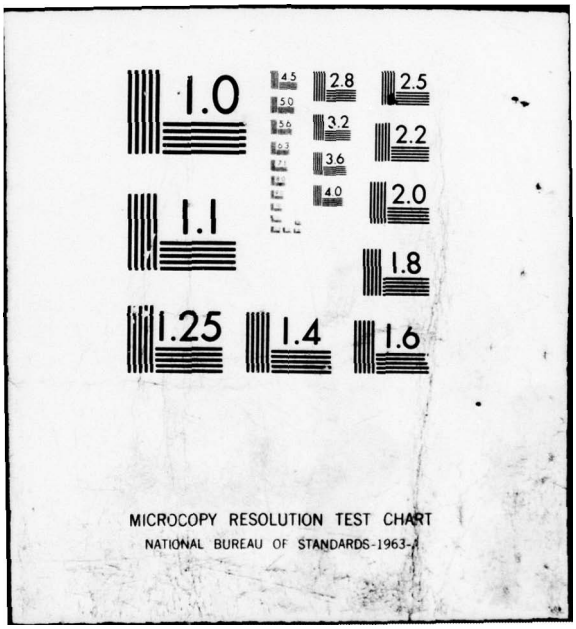
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(6) National Dam Inspection Program. Big Piney Run Dam (Inventory Number NDS-MD-9), Ohio River Basin, Piney Creek, Garrett County, Maryland. Phase I Inspection Report.

LEVEL II (1)

OHIO RIVER BASIN

BIG PINEY RUN DAM

STATE OF MARYLAND

(12) 56p GARRETT COUNTY

INVENTORY NUMBER NDS MD-9

PHASE I INSPECTION REPORT

NATIONAL DAM INSPECTION PROGRAM

(11) Aug 78

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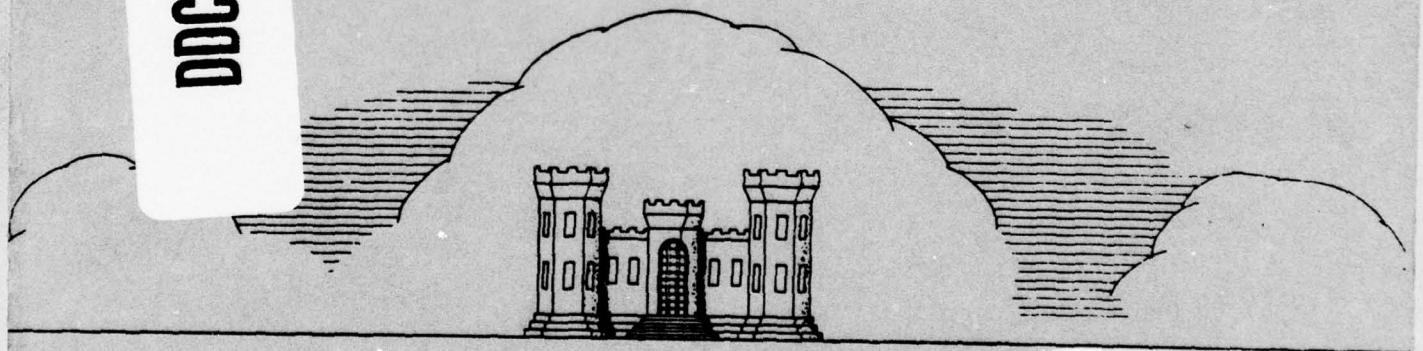


Prepared For
DEPARTMENT OF THE ARMY
Baltimore District, Corps of Engineers
Baltimore, Maryland

411003

by

BERGER ASSOCIATES, INC
CONSULTING ENGINEERS
HARRISBURG, PA.

AUGUST 1978

PHASE I REPORT
NATIONAL DAM INSPECTION PROGRAM

Name of Dam:	BIG PINEY RUN DAM
State & State No.	MARYLAND - MD. 9
County:	GARRETT
Stream:	Piney Creek
Date of Inspection:	July 11, 1978

Based on the past performance, available engineering data and the visual inspection, the dam appears to be in fair condition. The following recommendations are presented for action by the owner.

1. The embankment adjacent to the first buttress wall shall be backfilled to the top of dam elevation.

2. The leakage through joints between buttresses and slab shall be monitored and corrective action shall be taken if this leakage increases to such a level, that it would endanger the structure.

3. The operator stand for the sluice gate should be secured to the supporting slab.

4. It is urged that repairs to the concrete structure shall be made to prevent further serious deterioration.

5. Trees on the embankment shall be removed.

This project will pass 52 percent of the PMF (Probable Maximum Flood), without overtopping the dam. In accordance with the Corps of Engineers' guidelines, the spillway capacity is considered to be adequate.

A formal surveillance and downstream warning system should be developed by the owner to be used during periods of heavy or prolonged rainfall.

SUBMITTED BY:

BERGER ASSOCIATES, INC.
HARRISBURG, PENNSYLVANIA

DATE: August 25, 1978

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
RODNEY VINCENT HOUSEAL
ENGINEER
No. 4756-E

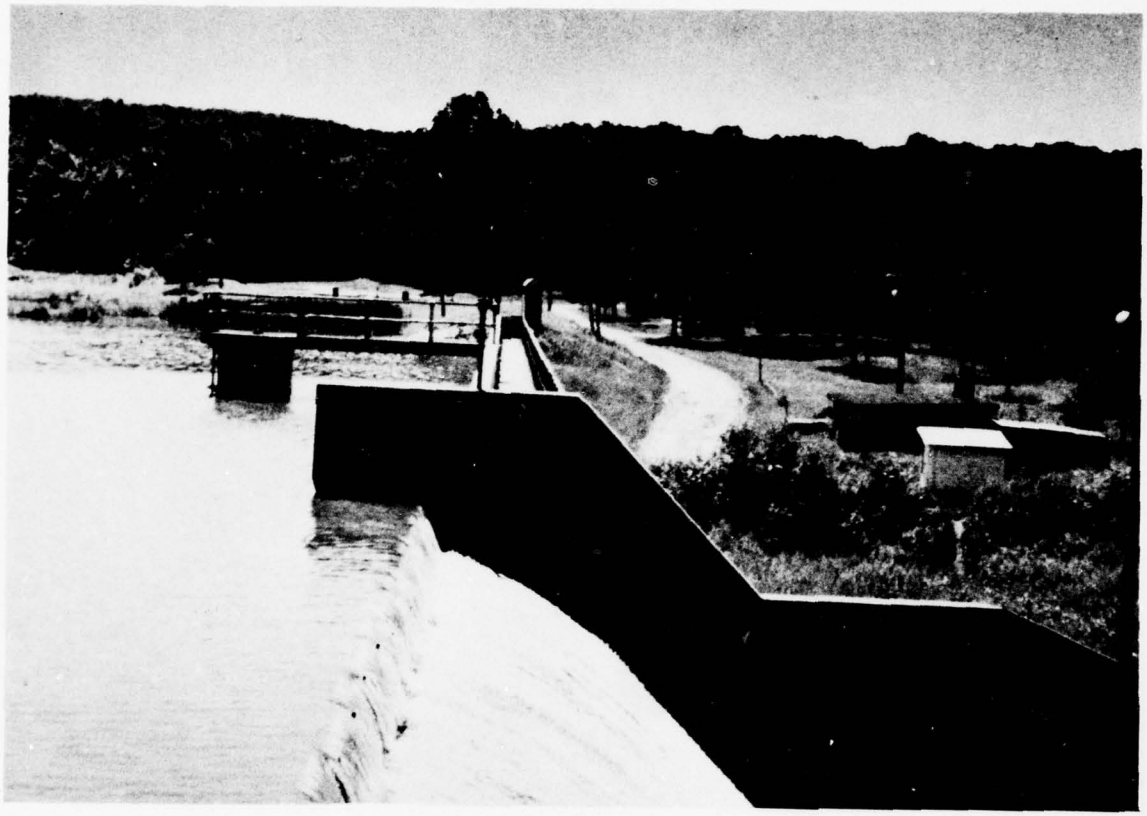
Rodney V. Houseal

APPROVED BY:

John H. Kenworthy

JOHN H. KENWORTHY
LTC, Corps of Engineers
Acting District Engineer

DATE: 15 Aug 78



OVERVIEW

SECTION 1 - PROJECT INFORMATION

1.1 GENERAL

A. Authority

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspections of dams throughout the United States. The Phase I Inspection and Report are limited to a review of available data, a visual inspection of the dam site and basic calculations to determine the hydraulic adequacy of the spillway.

B. Purpose

The purpose is to determine if the dam constitutes a hazard to human life and property.

1.2 DESCRIPTION OF PROJECT

A. Description of Dam and Appurtenances

Big Piney Run Dam (indicated on U.S.G.S. Quadrangle Avilton, MD-PA, as Frostburg Reservoir) is a concrete buttress dam founded on rock. Maximum height above streambed is 23 feet, the maximum structural height is approximately 39 feet. The length of the concrete structure is 420 feet, which includes a 103.5 feet long ogee type spillway located close to the right abutment. The left abutment is a 270 feet long earthfill embankment with a concrete core wall. Maximum height of this earthfill is approximately 9 feet. See Appendix D, Plates VII, VIII and IX for details of the dam. The intake structure is located upstream from the concrete buttress portion and is accessible by a concrete bridge. Sluice gate and gate valve operator stand are located on top of the intake structure. The top of dam is at elevation 2360 and the top of spillway is at elevation 2352. Two feet high flashboards were installed in 1966.

B.	Location:	Garrett County, Maryland U.S. Quadrangle, Avilton, MD-PA Latitude 39°-42.3', Longitude 74°-0.7' (Appendix D, Plates I and II)
C.	Size Classification:	Small (height 23 feet, storage 480 acre-feet)
D.	Hazard Classification:	Significant (see Section 3.1.F)
E.	Ownership:	City of Frostburg, Maryland Municipal Building 37 Broadway Frostburg, Maryland 21532

F. Purpose: Water supply for City of Frostburg, Md.

G. Design and Construction History

The dam was designed for the owner by Whitman, Requardt and Smith, Baltimore, Maryland. A permit application was made and a permit for construction was issued on October 27, 1934. The contractor for this project was George F. Hazelwood, Cumberland, Maryland, and construction was completed in March, 1935. It was first proposed to construct an earthfill dam at this site, but impervious material was not available close to the site, so a concrete buttress design was selected as the most appropriate solution.

H. Normal Operation Procedures

Water is taken out of the lake for domestic water supply by a 12-inch pipe. Two 12-inch gate valves at different elevations control the level of intake. A pump house is located downstream of the dam from where the water is pumped through a 10-inch line to Frostburg.

There is also a 30-inch sluice gate on the intake tower and a 30-inch blowoff pipe to a downstream outlet structure. When the pool level increases to two feet above the flashboards, the 30-inch sluice gate is opened to prevent possible collapse of the flashboard pins.

1.3 PERTINENT DATA

A. Drainage Area (square miles)	11.9
B. Discharge at Dam Site (cubic feet per second) For hydraulic calculations see Appendix B.	
Maximum known flood at dam site	970
Outlet conduit at low pool Elev. 2340	32
Outlet conduit at pool Elev. 2354	94
Spillway capacity at pool Elev. 2360 (top of dam) and no flashboards	8,550
Spillway capacity at pool Elev. 2360 (top of dam) with flashboards in place	5,050
C. Elevation (feet above mean sea level)	
Top of earth embankment	2,360
Top of parapet on concrete wall	2,360

Top of sidewalk on buttress dam	2,356
Spillway crest	2,352
Top of flashboards (normal pool)	2,353.9
Upstream invert of conduit	2,337
Downstream invert of conduit	2,336
Streambed elevation at dam	2,337
Maximum tailwater (estimated)	2,348

D. Reservoir (miles)

Length of maximum pool (Elev. 2360)	.8
Length of normal pool (Elev. 2352)	.5

E. Storage (acre-feet)

Spillway crest (Elev. 2352)	120
Normal pool (Elev. 2353.9) (as surveyed in 1975)	175
Top of dam (Elev. 2360)	440

F. Reservoir Surface (acres)

Normal pool (Elev. 2353.9)	36
Top of dam (Elev. 2360)	52

G. Dam

For plans and sections see Appendix D, Plates VII, VIII and IX.

Type: Concrete buttress and earthfill abutment.

Length: Buttress 320 feet, earthfill 270 feet.

Height: Concrete structural height 39 feet.
Earthfill 9 feet above original ground.

Top Width: Embankment 10 feet.

Side Slopes: Embankment - Upstream 3H to 1V
Downstream 2.5H to 1V

Zoning: Concrete core wall to Elev. 2358

Cutoff: Concrete core wall

Grout Curtain: None

H. Regulating Conduit

Type: 30-inch diameter cast iron pipe

Length: 100 feet.

Closure: 30-inch sluice gate (manually operated) on outside of intake tower at the upstream side of the dam.

Access: Concrete bridge from the dam.

I. Spillway

Type: Ogee with flashboards installed.

Length: 103.5 feet

J. Regulating Outlet

See Section 1.3.H.

SECTION 2 - ENGINEERING DATA

2.1 DESIGN

A. Data Available

1. Hydrology and Hydraulics

The files of the Maryland Water Resources Administration of the Department of Natural Resources (DNR) contained a letter by the design engineers to the Water Resources Commission stating that the maximum spillway capacity to the top of dam equals 8800 cfs (no freeboard). Using a two feet freeboard the capacity would be reduced to 5630 cfs. There was no other hydrologic or hydraulic information available.

2. Dam and Embankment

The files of DNR contained three construction drawings for this project (Appendix D, Plates VI through VIII). The previously referenced letter also contained the results of test pits and the geological formation at the site. A design memorandum states that the cutoff wall and the buttress walls will be founded on solid rock.

Further design data and design criteria were not available in the files.

3. Appurtenant Structures

Design criteria and design data for the spillway and intake structure were not available in the files. Construction details are shown on the drawings in Appendix D.

B. Design Features

1. Embankment

A typical section for this portion of the facilities is shown on Plate VII, Appendix D. The earthfill embankment is 270 feet long with an approximate maximum height of 9 feet above the original groundline. The foundation for the embankment was stripped and a trench was excavated to a depth of about 8 feet. A reinforced concrete cutoff wall was constructed to elevation 2358. The upstream slope is 3H to 1V and is protected by hand placed riprap. The downstream slope is 2.5H to 1V and is seeded.

2. Concrete Buttress Dam

The major part of these facilities is a concrete slab supported on buttresses (Appendix D, Plates VII and VIII). The buttresses are spaced at 15 foot centers and are 18 inches thick and have 30-inch wide footings. The footings are poured in a trench excavated in solid rock. Plate VIII indicates that the resultant forces in the buttress for an empty reservoir and for a full reservoir are located within the middle third of the buttress. A cutoff wall is located at the upstream side and connected monolythical with the buttresses to elevation 2335.9. The cutoff wall or slab is shown to be extended to solid seamless rock. The slab above elevation 2335.9 is poured in one monolythic pour to elevation 2356. This slab is, however, allowed to slide at one end on the buttress wall for expansion and contraction. The buttress has a 6-inch wide corbel on each side to give a wider support to this slab. At elevation 2356 a sidewalk is poured integral with the upstream slab. A 12-inch wide reinforced concrete parapet wall is placed on top of the sidewalk to the top of the dam elevation. The buttresses are given lateral stability by a 15-inch x 15-inch reinforced concrete strut at elevation 2335± and an arched concrete strut under the sidewalk. Backfill was placed between the buttresses up to elevation 2343±, which means that only about one-third of the structure is above finished ground.

3. Appurtenant Structures

The spillway or overflow section is an integral part of the buttress dam and located near the right abutment. The construction is similar with buttresses at 15 feet centers supporting the concrete slab which forms the ogee section. The downstream slab forms a small bucket and has a continuous concrete cutoff wall. Two-inch pipes were poured in top of the ogee section to allow installation of a flashboard supported by 1-1/4-inch pins.

The intake tower is located on the upstream side of the dam and is integral with the buttress and slab dam (Appendix D, Plate VII and IX). It is constructed of reinforced concrete and has an inside dimension of 4 by 5 feet. Two 12-inch intake pipes at elevation 2348 and 2342 respectively, are located in the sidewalls of the tower and intake is controlled by 12-inch gate valves located inside the tower. The valve operator stands are on top of the tower. A 30-inch sluice gate is at elevation 2337 and is also opened by an operator stand on top of the tower.

C. Design Data

1. Hydrology and Hydraulics

The existing files at DNR did not contain any hydrologic or hydraulic design data except that a report stated that the maximum

spillway design discharge to the top of dam was 8800 cfs, and that with two feet freeboard the discharge would be 5630 cfs. The suggested spillway capacity was 7500 to 8000 cfs.

2. Buttress Dam and Embankment

The files did not contain design criteria or design data for this structure. The results of some test pits are in the file.

3. Appurtenant Structures

Design criteria or design data for the appurtenant structures were not available for review.

2.2 CONSTRUCTION

The available construction data consisted of the design drawings. As-built drawings were not available for review and the files did not contain specifications or construction photographs.

2.3 OPERATION

The purpose of the dam is to supply domestic water to the City of Frostburg. Formal records of operation are not maintained. To increase the amount of impounded water, flashboards (24-inches high) were installed in 1966. Considerable siltation has occurred, especially in the upper regions of the reservoir. The reservoir was surveyed in 1975 and sedimentation of 2 to 3 feet has reduced the impounded water from 70 to 57 million gallons (215 acre-feet to 175 acre-feet).

2.4 EVALUATION

A. Availability

The only available design data consisted of the design drawings and two memorandums indicating results of test pits and the discharge capacity of the spillway.

B. Adequacy

1. Hydrology and Hydraulics

Design criteria and data were not available, except that the discharge capacity of the spillway was calculated as 8800 cfs, with no freeboard and that the design discharge should be 7500 to 8000 cfs.

2. Embankment and Concrete Buttress Dam

The available design drawings indicate sufficient details to analyze the structure. However, no records were available to verify foundation elevations and to assess design stresses of concrete and reinforcing steel.

3. Appurtenant Structures

The design drawings indicate details of the spillway and intake tower. However, there were no design criteria and design data in the files.

C. Operating Records

No formal operating records are maintained. The highest level over the spillway occurred during hurricane Hazel in 1954. Flashboards were not installed at that time and no one recalls how high the pool level was. During the tropical storm Agnes (1972) the pool level reached about two feet above the flashboards.

About 15 years ago the lake was dredged but the owner stated that this was not very successful.

D. Post Construction Changes

No reported modifications have been made to this dam and appurtenant structures. Downstream a small levee was constructed to prevent backwater from flowing to the pump house and flashboards were installed in 1966. Provisions for these flashboards had been made on the original drawings.

E. Seismic Stability

The dam is located in Seismic Zone 1 and it is considered that the static stability is such that the dam will withstand minor earthquake induced dynamic forces under the normal safety margins used for static stability. No calculations were made to confirm this.

SECTION 3 - VISUAL INSPECTION

3.1 FINDINGS

A. General

The general appearance of the dam and its appurtenant structures is fair. The earthfill embankment is in good condition, but the concrete structure indicates some deterioration. The visual checklist is in Appendix A. Photographs taken during the inspection are reproduced in Appendix D, Plates III through VI.

B. Embankment

This low but relatively long earthfill abutment was in good condition. No signs of sloughing were detected and no seepage was noticed. Some trees were growing on the embankment, but the presence of a concrete core wall, the small height of the embankment and the relatively flat area downstream of this embankment makes these trees less objectionable. Adjacent to the first buttress wall the embankment crest has a depression for a length of 20 feet with a maximum depth of 15 inches.

C. Concrete Buttress Dam

Several light posts were installed on top of the parapet wall. The type of construction used for anchoring these light posts deteriorated the concrete and some deep gaps are in the parapet wall (Plate V, Appendix D). However the water coming through these gaps would not endanger the structure.

Some of the arched struts on the downstream side, located below the sidewalk, showed serious deterioration. Although the visual impression is unpleasant, these arches are not an important structural part of the dam.

All buttresses appeared to be in good condition, except one corbel in the third bay from the spillway. This corbel had deteriorated considerably over several feet length. Most of the buttress walls and concrete slabs could not be observed because approximately two-thirds of the height is underground.

Many of the concrete slabs showed signs of seepage, although no seepage was detected at the time of inspection. The owner's representative stated that seepage increases in the winter, when cooler weather opens the joints. Water was standing between many of the buttresses. This was caused by poor drainage and rainwater. Construction drawings

indicate that backfill was placed at a 2 percent slope away from the dam, which is not sufficient to allow for settlement.

In the seventh bay from the spillway two large cavities in the concrete slab were noticed. One cavity was 4.5 inches deep, the other approximately 6 inches. The cavities were over an area of 12 x 18 inches. The type of cavity indicates poor workmanship during construction. No excessive leakage was noticed.

D. Appurtenant Structures

The spillway overflow section is an integral part of the buttress dam. At the time of inspection the pool level was approximately 5 inches above the top of flashboards and a close inspection of the spillway surface was not feasible. Some deterioration of the ogee section was apparent and the joint between the spillway and abutment walls should be investigated. A keyed joint in the downstream right wingwall was heavily damaged, but does not appear to affect the safety of the structure. The damage is caused by difference in deflection and the outside part of the female key is sheared off.

The area underneath the ogee spillway was inspected. No serious leaking or deterioration was detected. The intake structure was accessible by a footbridge and the 30-inch sluice gate was opened during the inspection. The floor stand needs tightening. All gates and valves appeared to be in good condition.

E. Reservoir Area

The reservoir area is wooded, with some agriculture. A heavy rain on the previous day made the impounded water very turbid. It was stated by the owner that this is common and this indicates that siltation occurs. The banks of the reservoir appear stable without signs of erosion.

F. Downstream Channel

The downstream area of this dam is relatively undeveloped. About 4.5 miles downstream is a bridge and only one or two houses are located in the flood plain. The stream is in a wooded and partially agricultural valley, and 8.0 miles downstream of the dam is the confluence with the Casselman River. The expected loss of life from dam failure due to overtopping would be less than a few and the economical loss would be minimal. A potential hazard category of "significant" seems to be appropriate.

3.2 EVALUATION

The observed condition of the embankment portion of the dam is good. The concrete of the buttress type structure is in fair condition. Several locations had severe spalling and deterioration of concrete due to poor construction and the type of construction details used. If a local failure of the slab would occur, it is not expected that a total failure of the dam would result. Very little leakage was noticed at the time of inspection. Mr. Lloyd Yutzy, dam operator, lives at the site of the dam and at periods of high precipitation inspects the dam and opens the sluice gate. However, there is not a formal downstream warning system.

SECTION 4 - OPERATIONAL PROCEDURES

4.1 PROCEDURES

This impoundment dam is the principle supply of water for the City of Frostburg. Water from the lake is pumped over the mountain to the City. To increase the storage capacity, flashboards were installed in 1966, presumably as shown on the original construction drawings. Mr. Yutzy, dam operator, stated that he opens the sluice gates if the pool level is two feet above the flashboards.

4.2 MAINTENANCE OF DAM

The area of the facilities is checked on a daily basis by the operator who lives at the site. Very little maintenance on the concrete structure has been done over the years. Most joints are in poor condition and frost damage could considerably decrease the effective life of this structure. The earthfill embankment is in good condition.

4.3 MAINTENANCE OF OPERATING FACILITIES

According to Mr. Yutzy, dam operator, the valves are operated on a fairly regular basis. The valve stands were greased and the 30-inch sluice gate opened easily. The operator stand is loose and should be tightened to the floor slab.

4.4 WARNING SYSTEM

There is no formal downstream warning system in effect.

4.5 EVALUATION

The general operational procedures are acceptable, except that no formal warning system is in effect. Better maintenance of the facilities should be encouraged.

SECTION 5 - HYDROLOGY/HYDRAULICS

5.1 EVALUATION OF FEATURES

A. Design Data

The hydrologic and hydraulic analysis available from Maryland DNR for Big Piney Run Dam indicates no design hydrograph, flow routing or discharge curve were contained in the files. The files did contain the designer's storage curve and a statement that the spillway could pass 8800 cfs without overtopping.

A spillway rating curve has been developed for this report using the information in the construction drawings.

B. Experience Data

In the period since the dam has been built in 1934, the maximum flood was that which occurred in 1954; however, there is no record of the water level or discharge from that flood. In 1972, a flood discharge of almost 1000 cfs was passed without distress.

C. Visual Observations

On the date of the inspection no conditions were observed that would indicate that the appurtenant structures of the dam could not operate satisfactorily during a flood event.

D. Overtopping Potential

This dam has an overall height of 23 feet above streambed and a maximum storage capacity of approximately 440 acre-feet calculated to the top of the dam. These dimensions indicate a size classification of "Small". The hazard classification is "Significant" (Section 3.1.F).

The recommended Spillway Design Flood (SDF) for a dam with the above classifications is the 100-year frequency flood to one-half of the Probable Maximum Flood (PMF). The PMF for this site is 16,900 cfs and the spillway capacity without the flashboards is 8,550 cfs or about 51% of the PMF peak inflow. This would indicate that the potential for overtopping does not exist. The flashboards are expected to fail under a head of 3.5 feet (Section 6.1.B.3); however, with the flashboards in place, the spillway capacity is 5,050 cfs or about 30% of the PMF peak inflow. This would indicate that the potential for overtopping exists. An estimate of the storage effect of the reservoir shows that the Big Piney Run Reservoir does not have the storage available that is necessary to pass the one-half PMF peak inflow with flashboards in place without overtopping.

The spillway and reservoir together can pass a flood equal to 52% of a PMF without the flashboards and 31% of a PMF with the flashboards in place.

E. Spillway Adequacy

Since the unobstructed spillway capacity of 8,550 cfs and the storage effect of the reservoir can pass 52 percent of the PMF, the spillway is considered to be adequate.

The hydrologic analysis for this investigation was based upon existing conditions of the watershed. The effects of future development were not considered.

SECTION 6 - STRUCTURAL STABILITY

6.1 EVALUATION OF STRUCTURAL STABILITY

A. Visual Observation

1. Embankment

There were no visual indications of undue embankment stresses or sloughage. The embankment was in excellent shape, except for the presence of a few trees on the slopes, which are not considered to be detrimental to the satisfactory operation of the facilities.

2. Buttress Dam

The visual inspection indicated that considerable spalling of concrete has occurred at expansion joints. These, however, do not effect the structural integrity of the dam. The seventh bay from the spillway has large cavities in the concrete, probably since construction. No water was leaking through. Although a considerable reduction in section occurs at these locations, no immediate cause of concern exists. These holes are approximately 12 feet below top of dam, or 6 feet below normal pool elevation.

Besides the spalling, the deterioration of concrete and temperature cracking, no signs of undue strain or stress were discovered and it appears that the structure is stable and did not suffer from differential settlement.

3. Appurtenant Structures

During the inspection the spillway discharged approximately five inches over the flashboards and close inspection was not feasible. It appears that some deterioration of concrete has occurred on the downstream face of the ogee section. The joints between the ogee and the abutment needs some repair. The spalling of the expansion joint in the downstream wingwall does not affect the structural stability. The intake tower appeared to be in satisfactory condition.

B. Design and Construction Data

1. Embankment

There were no design criteria or design data available for review. The typical section shown on Plate VII, Appendix D, indicates a section of sufficient dimension and details for this relatively low structure.

2. Buttress Dam

Design criteria and design data were not available for review except a full set of design drawings. The section on Plate VIII indicates that the resultant force in the buttresses falls within the third point. Actual foundation elevations and depth of cutoff walls are not known. In Appendix C, calculations have been made to check the reinforcing and shear stresses in the slab. It appears that these are adequate and that the structure is stable under existing loading conditions.

3. Appurtenant Structures

A review of the design drawings indicate that the design of the spillway and intake structure are based on acceptable engineering principles. All structures were to be founded on solid rock. In Appendix C, calculations indicate that the flashboard support will yield when pool level reaches 3.5 feet above flashboard, assuming that steel rods were used for the pins.

C. Operating Records

There were no formal operating records available for review. Maximum pressures on the structure must have occurred during Hurricane Hazel (1954) and tropical storm Agnes (1972). Most of the deterioration of the concrete structure has occurred due to expansion and contraction and due to poor quality control during construction.

D. Post Construction Changes

The only reported modification to the original construction is the installation of flashboards in 1966. The details for these boards were included in the design drawings.

E. Seismic Stability

This dam is located in Seismic Zone No.1 and it is considered that the static stability is sufficient to withstand minor earthquake induced dynamic forces. However, no calculations, studies, etc., were made to confirm this conclusion.

SECTION 7 - ASSESSMENT AND RECOMMENDATIONS

7.1 DAM ASSESSMENT

A. Safety

The visual inspection, the review of available design data and the operational history indicates that the dam is in fair condition and has been constructed in accordance with acceptable engineering practice.

In accordance with the Corps of Engineers' guidelines, this project can pass 52 percent of the PMF (Probable Maximum Flood) without overtopping the dam; therefore, the spillway capacity is considered to be adequate.

B. Adequacy of Information

Although the available information was limited, it is considered adequate to make a reasonable assessment of the project.

C. Urgency

The recommendations made in this section should be implemented as soon as possible.

D. Necessity for Additional Studies

Additional studies are not required at this time. However, attention should be given to the recommendations given below.

7.2 RECOMMENDATIONS

A. Facilities

In order to assure continued satisfactory operation of this dam, the following recommendations are made:

1. The owner shall backfill the low area on the embankment adjacent to the first buttress wall immediately.

2. The owner shall monitor the leakage through the joints in the slab and buttresses. If leakage increases, corrective measurements shall be taken to prevent serious damage to the structure.

3. The owner shall remove the trees growing on the embankment.

B. Operation and Maintenance Procedures

1. The sluice gate operator stand shall be secured to its supporting slab.

2. A formal surveillance and downstream warning system shall be developed by the owner to be used during periods of high precipitation.

3. To prevent serious deterioration of the facilities and to extend the usable life of the structure, it is recommended that the owner shall develop a maintenance program for these facilities and repair all deteriorated concrete.

APPENDIX A

VISUAL INSPECTION

CHECK LIST - DAM INSPECTION PROGRAM

PHASE I - VISUAL INSPECTION REPORT

NAD NO. 9

NAME OF DAM Big Piney Run Dam HAZARD CATEGORY Low

TYPE OF DAM Earthfill and Concrete Buttress

LOCATION Garrett COUNTY, MARYLAND

INSPECTION DATE 7/12/78 WEATHER Clear - Warm TEMPERATURE 70's

INSPECTORS: H. Jongsma, R. Houseal
R. Shireman, A. Bartlett

City of Frostburg
John Roland
Margaret Jones
Lloyd Yutzy

Maryland State
Jeff Smith
Tom Moynahan

NORMAL POOL ELEVATION 2353.9 (Flashboards) AT TIME OF INSPECTION

BREAST ELEVATION 2360 POOL ELEVATION 2354.3

SPILLWAY ELEVATION 2352 TAILWATER ELEVATION 2338

MAXIMUM RECORDED POOL ELEVATION 1954 (Hurricane Hazel) - Unknown
1972 (Agnes) - 2356±

GENERAL COMMENTS:

Reservoir was dredged about 15 years ago - not very successful.
Reservoir is major water supply for City of Frostburg.
Nearest town is Pine Grove, located above flood plain.
Flashboards installed in 1966.
Sloped slab in seventh bay from spillway has two holes (4.5 and 6.0 inches deep). Holes approximately 12 inches by 18 inches.
Standing water between buttresses due to poor drainage.

VISUAL INSPECTION

(Only left portion of Dam

EMBANKMENT	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. SURFACE CRACKS	None	
B. UNUSUAL MOVEMENT BEYOND TOE	None	
C. SLOUGHING OR EROSION OF EMBANKMENT OR ABUTMENT SLOPES	None	
D. VERTICAL & HORIZONTAL ALIGNMENT OF CREST	O.K. horizontal. Vertical - 15" depression adjacent to the left end of the buttress at juncture with the embankment (length 20'±).	
E. RIPRAP FAILURES	None	
F. JUNCTION EMBANKMENT & ABUTMENT OR SPILLWAY	Junction left of buttress with embankment - O.K.	
G. SEEPAGE	None in the embankment section.	
H. DRAINS	None	
J. GAGES & RECORDER	None	
K. COVER(GROWTH)	Top grass covered Downstream grass covered 2-3 pine trees. Upstream - hand laid rock.	

VISUAL INSPECTION

OUTLET WORKS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. INTAKE STRUCTURE	Concrete tower Three - controls on exposed deck.	
B. OUTLET STRUCTURE	Concrete endwall for 30" pipe.	
C. OUTLET CHANNEL	Short distance directly to spillway channel directed 45° toward main stream.	
D. GATES	1 - 30" Sluice Gate - Direct Discharge 2 - 12" Gate Valves (supply)	
E. EMERGENCY GATE	1 - 30" Sluice Gate Opened easily by dam operator Regularly operated	
F. OPERATION & CONTROL	Good	
G. BRIDGE (ACCESS)	Concrete bridge.	

DAM NO. NAD 9

VISUAL INSPECTION

SPILLWAY	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. APPROACH CHANNEL	Directly from the reservoir - Unobstructed.	
B. WEIR: Crest Condition Cracks Deterioration Foundation Abutments	Ogee section with 2'± flashboards - water flowing 5" over flashboards Ogee section - exposed aggregate Abutments - left and right deteriorating along ogee flow line, with spalling and cracking	
C. DISCHARGE CHANNEL Lining Cracks Spilling Basin	No stilling basin (small bucket) Natural stream.	
D. BRIDGE & PIERS	None	
E. GATES & OPERATION EQUIPMENT	None _ direct overflow	
F. CONTROL & HISTORY	Flashboards installed in 1966.	

DAM NO. NAD 9

VISUAL INSPECTION

MISCELLANEOUS	OBSERVATIONS	REMARKS & RECOMMENDATIONS
INSTRUMENTATION		
Monumentation		
Observation Wells	None	
Weirs	None	
Piezometers	None	
Other	None	
RESERVOIR		
Slopes	Wooded	
Sedimentation	Yes Very turbid water after rain.	
DOWNSTREAM CHANNEL		
Condition	Good - woods close to stream	
Slopes	O.K.	
Approximate Population	None as per City Representative.	
No. Homes	None	

DAM NO. NAD 9

VISUAL INSPECTION

CONCRETE/MASONRY DAM	OBSERVATIONS	REMARKS & RECOMMENDATIONS
A. SEEPAGE	None - calcium stains and eposits judged to be from previous leaking. Leaks more in winter.	
B. ABUTMENT JOINTS	Good	
C. DRAINS	None	
D. WATER PASSAGE	Spillway ogee section.	
E. FOUNDATION	Could not observe	
F. CONCRETE SURFACE	Heavily weathered. Breaks on top wall near tower access bridge.	
G. STRUCTURAL CRACKS	Heavy spalling and breakage on numerous buttress walls at jointure with the base of the arched section.	
H. HORIZONTAL & VERTICAL ALIGNMENTS	Horizontal alignment - O.K. Vertical alignment - O.K.	
J. MONOLITH JOINTS	Spalling and weathering	
K. . STAFFGAGE & RECORDER	None	
	Tunnel through ogee spillway - inspected and found to be dry and in good condition.	

APPENDIX B

HYDROLOGY/HYDRAULICS

BY RLS DATE 7/21/78 **BERGER ASSOCIATES** SHEET NO. 1 OF 5
CHKD. BY DATE PROJECT D 7530
SUBJECT BIG PINEY RUN DAM

MAXIMUM KNOWN FLOOD AT DAMSITE

THE GREATEST FLOOD THAT HAS BEEN EXPERIENCED AT THIS DAM OCCURRED IN 1954 AS A RESULT OF HURRICANE HAZEL; HOWEVER THERE IS NO RECORD OF THE WATER LEVEL FROM THIS FLOOD. IN 1972 THE FLOOD WATER REACHED A LEVEL ABOUT TWO FEET ABOVE THE TOP OF THE FLASHBOARDS.

$H = 2'$
$L = 103.5'$
$C = 3.32$ (TABLE 5-3 KING'S HDBK.)

$$Q = C L H^{3/2}$$
$$= 3.32 \times 103.5 \times (2)^{3/2} = 972 \text{ CFS}$$

OUTLET WORKS DISCHARGE AT NORMAL POOL LEVEL

30" DIA. SLUICE GATE $C = 0.6$

$H = 2354 - 2338.2 = 15.8'$

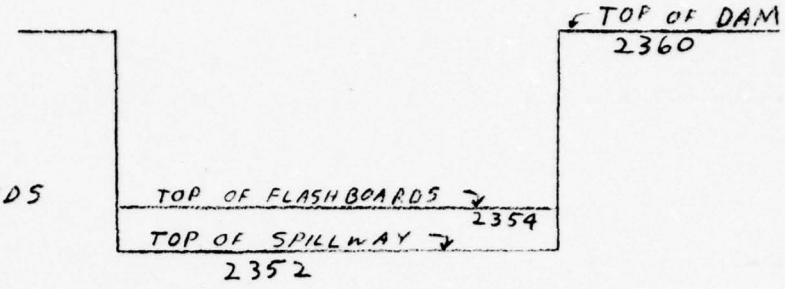
$$Q = CA\sqrt{2gH}$$
$$= 0.6 \times (\pi \times 2.5^2/4)\sqrt{2 \times 32.2 \times 15.8}$$
$$= 94 \text{ CFS}$$

AT LOW POOL $H = 2340 - 2338.2 = 1.8'$

$$Q = CA\sqrt{2gH}$$
$$= 0.6 \times (\pi \times 2.5^2/4)\sqrt{2 \times 32.2 \times 1.8}$$
$$= 32 \text{ CFS}$$

BY RLS DATE 7/21/75 **BERGER ASSOCIATES** SHEET NO. 2 OF 5
CHKD. BY DATE PROJECT D-7530
SUBJECT BIG PINEY RUN DAM

SPILLWAY CAPACITY



$L = 103.5'$

FLOW OVER FLASHBOARDS

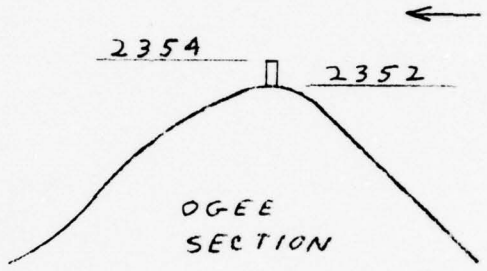
$C = 3.32$

$H = 2360 - 2354 = 6'$

$Q = C L H^{3/2}$

$= 3.32 \times 103.5 \times 6^{3/2}$

$= 5050$ CFS



$C = 3.65$ (FIG. 5-15 KING'S HDBK)

WITH FLASHBOARDS REMOVED

$C = 3.65$

$H = 2360 - 2352 = 8'$

$Q = C L H^{3/2}$

$= 3.65 \times 103.5 \times 8^{3/2}$

$= 8548$ USE 8550 CFS

SIZE CLASSIFICATION

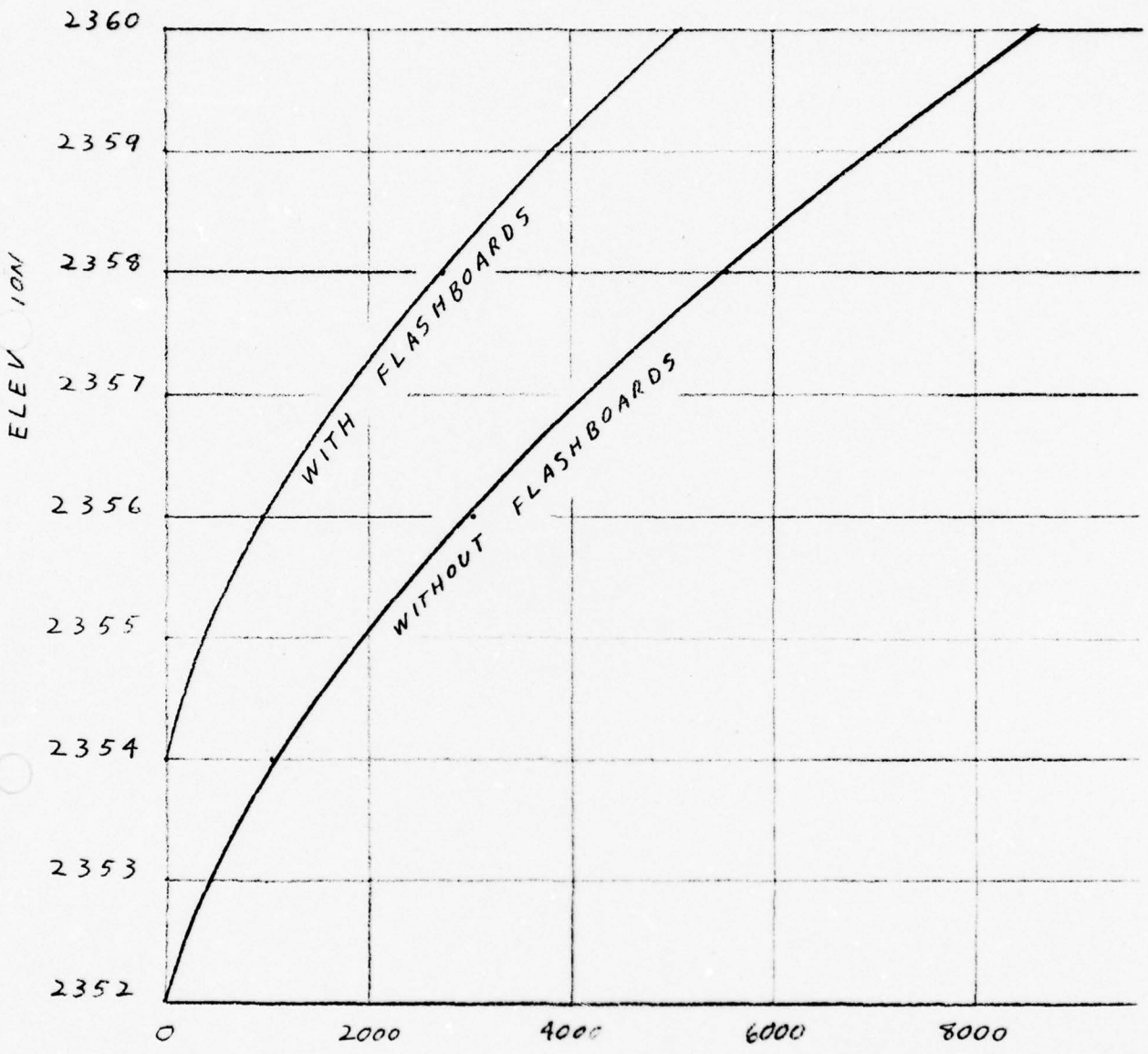
MAXIMUM STORAGE = 440 AC-FT
MAXIMUM HEIGHT = 23 FT.
SIZE CLASSIFICATION IS SMALL

HAZARD CLASSIFICATION

DOWNSTREAM AREA IS WOODED AND FARM LAND.
VERY FEW HOUSES. USE SIGNIFICANT.

BY RLS DATE 1/21/78 **BERGER ASSOCIATES** SHEET NO. 3 OF
CHKD. BY DATE PROJECT D 7530
SUBJECT BIG PINEY RUN DAM

SPILLWAY DISCHARGE



BY RLS DATE 8/16/78 **BERGER ASSOCIATES** SHEET NO. 4 OF 5
CHKD. BY DATE PROJECT
SUBJECT BIG PINEY RUN DAM

PMF

DRAINAGE AREA = 11.85 SQ. MI.

PMF = 1425 CFS/SQ.MI. (FROM C of E CURVE)
= 16886 CFS USE 16900 CFS

RUNOFF = 26" (FROM C of E)
= 16422 AC-FT.

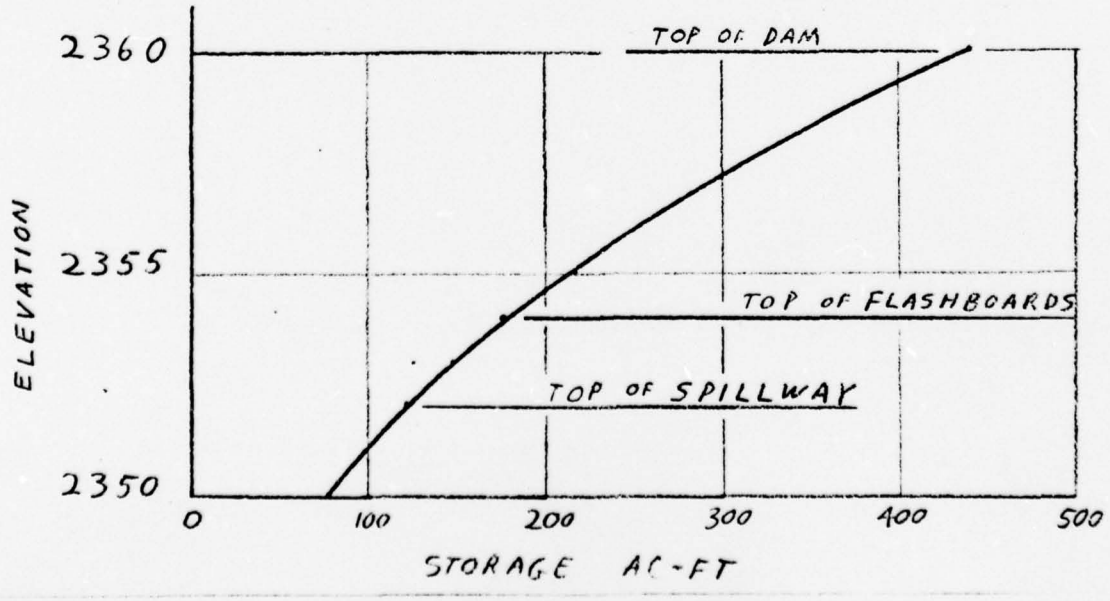
PMF/2 = 16900/2 = 8450 CFS

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{PEAK INFLOW}} = \frac{8550}{16900} = .506 \text{ SAY } 51\%$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL. OF INFLOW}} = .494$$ (FROM BALT. DIST. C of E. SHORTCUT ROUTING METHOD)

REQD. RES. STORAGE = .494 x 16422 = 8112 AC-FT

STORAGE CAPACITY



BY RLS DATE 2/24/78 **BERGER ASSOCIATES** SHEET NO. 5 OF 5
CHKD. BY DATE PROJECT D 7530
SUBJECT BIG PINEY RUN DAM

STORAGE AVAILABLE BETWEEN TOP OF FLASHBOARDS AND TOP OF DAM

440 - 175 = 265 AC-FT.

WITH FLASHBOARDS IN PLACE

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{PEAK INFLOW}} = \frac{5050}{16900} = .299 \quad \text{SAY } 30\%$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL. OF INFLOW}} = .701 \quad \text{(FROM SHORTCUT METHOD)}$$

REQD. RES. STORAGE = .701 X 16422 = 11512 AC-FT

FOR ONE HALF PMF

$$\frac{\text{MAX DISCHARGE}}{\text{PEAK INFLOW}} = \frac{5050}{8450} = .598 \quad \text{SAY } 60\%$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL. OF INFLOW}} = .402 \quad \text{(FROM SHORTCUT METHOD)}$$

REQD. RES. STORAGE = .402 x 16422 x .5 = 3301 AC-FT

55% PMF

16900 X .55 = 9295 CFS
16422 X .55 = 9032 AC-FT

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{55\% PMF PEAK INFLOW}} = \frac{8550}{9295} = .92 = 92\%$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL OF INFLOW}} = .08$$

REQD. RES. STORAGE = .08 × 9032 = 723 AC-FT

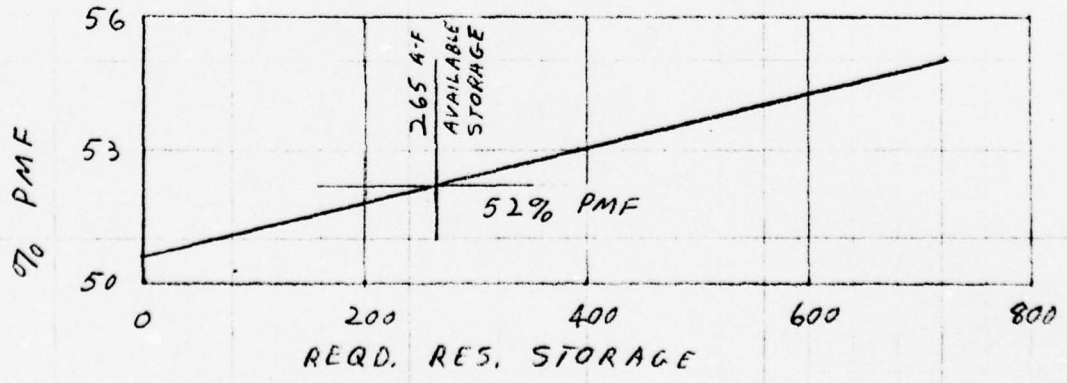
53% PMF

16900 X .53 = 8957 CFS
16422 X .53 = 8704 AC-FT

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{53\% PMF PEAK INFLOW}} = \frac{8550}{8957} = .955 \text{ SAY } 95\%$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL. OF INFLOW}} = .045$$

REQD. RES. STORAGE = .045 × 8704 = 392 AC-FT



RESERVOIR AND SPILLWAY CAN PASS 52% OF A PMF

WITH FLASHBOARDS IN PLACE

35 % PMF

$.35 \times 16900 = 5915$ CFS

$.35 \times 16422 = 5748$ AC-FT

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{35\% PMF PEAK INFLOW}} = \frac{5050}{5915} = .854 \text{ SAY } 85\%$$

$$\frac{\text{REQD. RES. STORAGE}}{\text{VOL. OF INFLOW}} = .146$$

REQD. RES. STORAGE = $.146 \times 5748 = 839$ AC-FT

33 % PMF

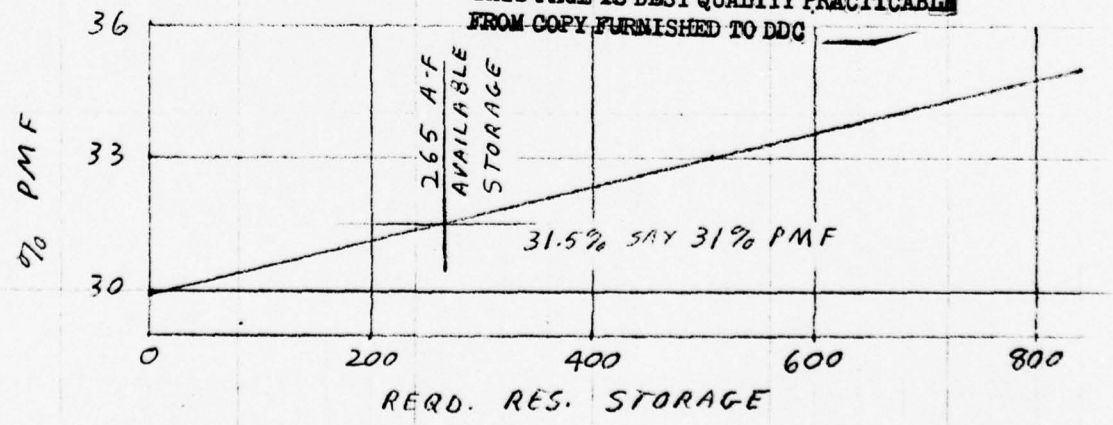
$.33 \times 16900 = 5577$ CFS

$.33 \times 16422 = 5419$ AC-FT

$$\frac{\text{MAX. SPILLWAY DISCHARGE}}{\text{33\% PMF PEAK INFLOW}} = \frac{5050}{5577} = .906 \text{ SAY } 91\%$$

$$\frac{\text{REQD RES. STORAGE}}{\text{VOL OF INFLOW}} = .094$$

REQD. RES. STORAGE = $.094 \times 5419 = 509$ AC-FT



WITH FLASHBOARDS IN PLACE, RESERVOIR AND SPILLWAY CAN PASS 31 % OF A PMF

APPENDIX C

GEOLOGIC REPORT
AND
STRUCTURAL CALCULATIONS

GEOLOGIC REPORT

Bedrock - Dam and Reservoir

Formation Name: Jennings Formation.

Lithology: Interbedded shale, siltstone and fine grained sandstone, with some conglomeratic sandstone. The prevailing colors are grayish green, olive, and chocolate brown. Weathered pieces are generally rusty in appearance, and frequently have limonite stained fossil molds.

Structure

The dam is located a short distance west of the crest of the Deer Park anticline. The beds strike N40°E and dip gently - less than 10° - to the NW. Fracture traces have the following trends: N40°-45°W, N60°W, N0°W, N10°W and N40°E.

Overburden

Overburden at the site consists of weathered bedrock and alluvium in the stream valley. Logs of test pits indicate that the shale on the valley side was weathered to depths of about ten feet. In the stream valley the alluvium consisted of sand, gravel and clay, generally less than ten feet thick. Bedrock below the alluvium showed only two or three feet of weathered rock. No fracturing of the bedrock was noted.

Aquifer Characteristics

The Jennings Formation has little primary permeability, and ground water movement is essentially all along bedding planes and fractures.

Discussion

The cutoff wall foundation was dug into fresh rock for the entire length of the dam. It is generally deeper than the test pits. The low dip of the bedding and the apparent absence of intense fracturing make leakage through the bedrock below the cutoff wall unlikely. Furthermore, the minerals in the bedrock are insoluble and unlikely to break down as the result of ground water movement.

Sources of Information

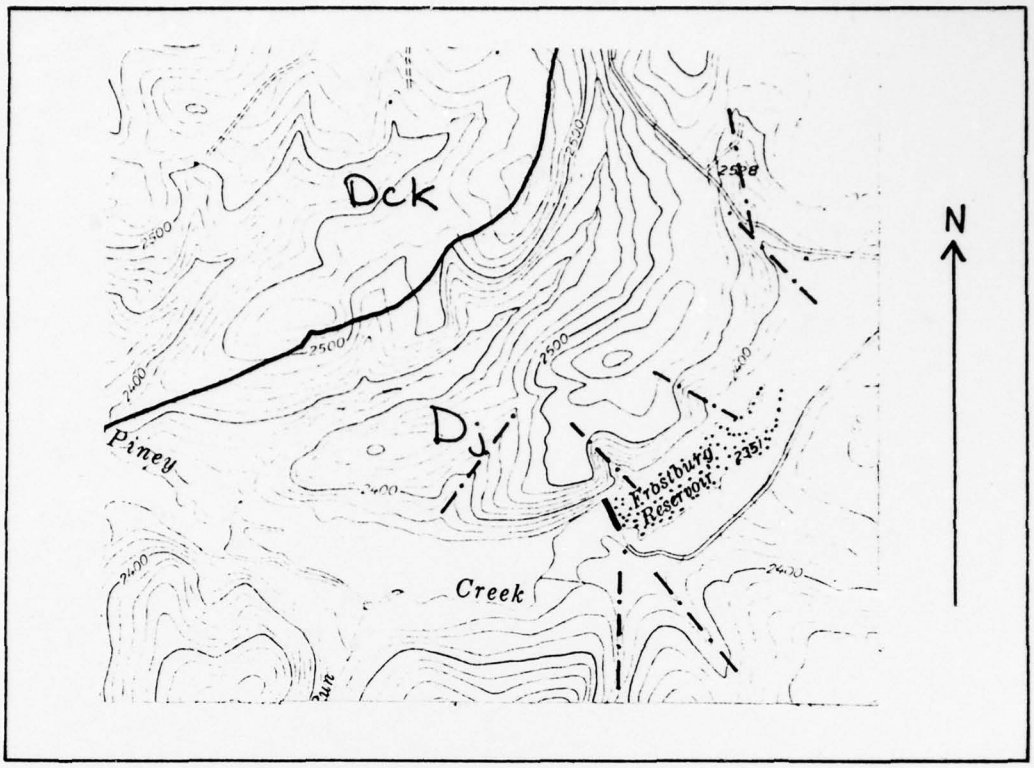
1. Maring, G.C. (1908 "Accident - Grantsville Folio, Maryland, Pennsylvania and West Virginia." U.S. Geological Survey Folio 160.

2. Flint, Norman K. (1965) "Geology and Mineral Resources of Southern Somerset County, Pa.". Pa. Geological Survey County Report C56A.

3. Air Photographs, scale 1:50,000.

4. Test Pit Logs in file.

GEOLOGIC MAP - FROSTBURG DAM



(geology from U.S.G.S. Folio #160)

KEY

Dck	Catskill Fm.
Dj	Jennings Fm.
—·— ·—	fracture trace

SCALE 1:24000

1 0 1 MILE

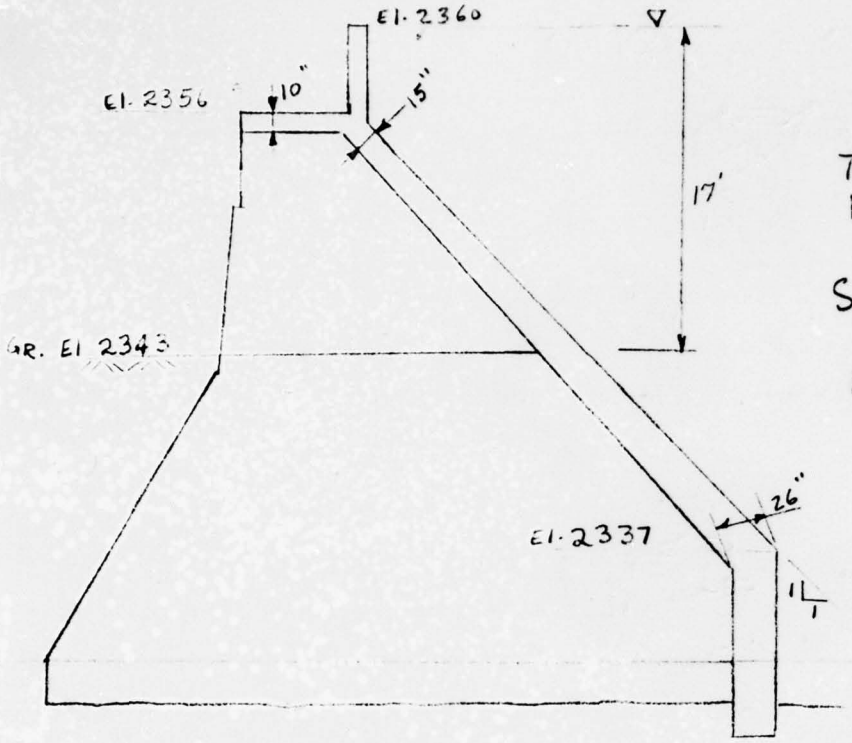
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

1 5 0 1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

BY DSB DATE 7/78 | BERGER ASSOCIATES | SHEET NO. 1 OF 2
CHKD. BY DATE | PINEY CREEK DAM, FROSTBURG, MD. | PROJECT D7530
SUBJECT BUTTRESS WALL

BUTTRESS WALL



Check slab capacity at Finished Ground Line
i.e. water ht = 17'
Thickness of slab @ Ground line = 22.5"

Spacing of buttresses = 15'-0"
∴ slab span (neglecting haunch) = 15 − 1.5 = 13.5'

Rein. in slab = 6-1"Φ (A_s = 6.0 in 4.5' or 1.333 in²/'

Effective 'd' = 22.5 − 2.5 − 0.5 = 19.5"
Conc. f'_c ~ 2,500 psi f_s = 16,000 psi
∴

Load on slab (normal):
Water = 17' × 0.0624 = 1.061 klf
Slab = $\frac{1}{\sqrt{2}}\left(\frac{22.5}{12} \times 15\right)$ = 0.199 klf
1.260 klf.

∴ Mom = $\frac{1}{8}(13.5)^2(1.26)$ = 28.70'k
V (@ d') = 1.26 [6.75' − 1.63'] = 6.45'k

Using $f_c = 0.45 f'_c$ = 1125 psi.
∴ K = 218 a = 1.13
∴ $d_{min} = \sqrt{\frac{28.70}{0.218}}$ = 11.47" < 19.5"

& A_s (reqd) = $\frac{28.70}{1.13 \times 19.5}$ = 1.302 in² < 1.333 in²/'
∴ O.K.

$v = \frac{6450}{12 \times 19.5}$ = 27.6 psi < f_c (allow) = 0.95$\sqrt{2500}$ = 47.5 ksi
O.K.

BY DSB DATE 1/78 | BERGER ASSOCIATES | SHEET NO. 2 OF
CHKD. BY DATE | PINEY CREEK DAM, FROSTBURG, MD. | PROJECT D7530
SUBJECT BUTTRESS WALL

Check slab at the bottom of sloped wall.

thickness of slab = 26" $d = 26-3 = 23"$
Ht. of water retained = $2360 - 2337 = 23'$
∴ Load on slab (normal)
Water = $0.0624 \times 23' = 1.435$ klf
Slab = $1/\sqrt{2}\,[26/12 \times .150] = 0.230$
1.665 klf.

$Mom = \frac{1}{8}(1.665)(13.5)^2 = 37.93^{'k}$
$V(@\ d) = 1.665(6.75 - 1.92) = 8.042^{k}/'$

$\therefore d(min) = \sqrt{\frac{37.93}{0.218}} = 13.2" < 23" \therefore$ O.K.

$v = \frac{8.042 \times 10^3}{12 \times 23} = 29.1$ psi < 47.5 psi $\therefore$ O.K.

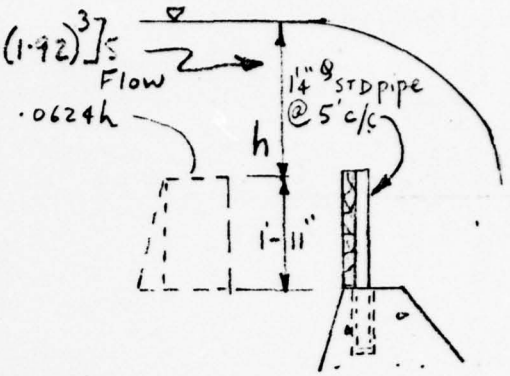
$A_s(\text{req'd}) = \frac{37.93}{1.13 \times 23} = 1.46\ in^2/'$

$A_s(\text{prov}) = \frac{8.0}{5} = 1.60\ in^2 > 1.46\ in^2/'$ $\therefore$ O.K.

BY DSB DATE 7/78 | BERGER ASSOCIATES | SHEET NO. 3 OF
CHKD. BY DATE | PINEY CREEK, FROSTBURG, MD. | PROJECT
SUBJECT FLASHBOARDS

FLASHBOARDS

O.T. Mom $= [0.0624h(1.92)(\frac{1.92}{2}) + \frac{1}{6}(.0624)(1.92)^3]$'k
$= [0.575h + 0.368]$'k
$= 6.9h + 4.417$"k



Capacity of pin $= F_y S_x$
($F_y = 36$ ksi) $= 0.235 \times 36 = 8.46$

$\therefore$ $6.9h + 4.417 = 8.46$
or $h = \frac{4.043}{6.9} = 0.586'$

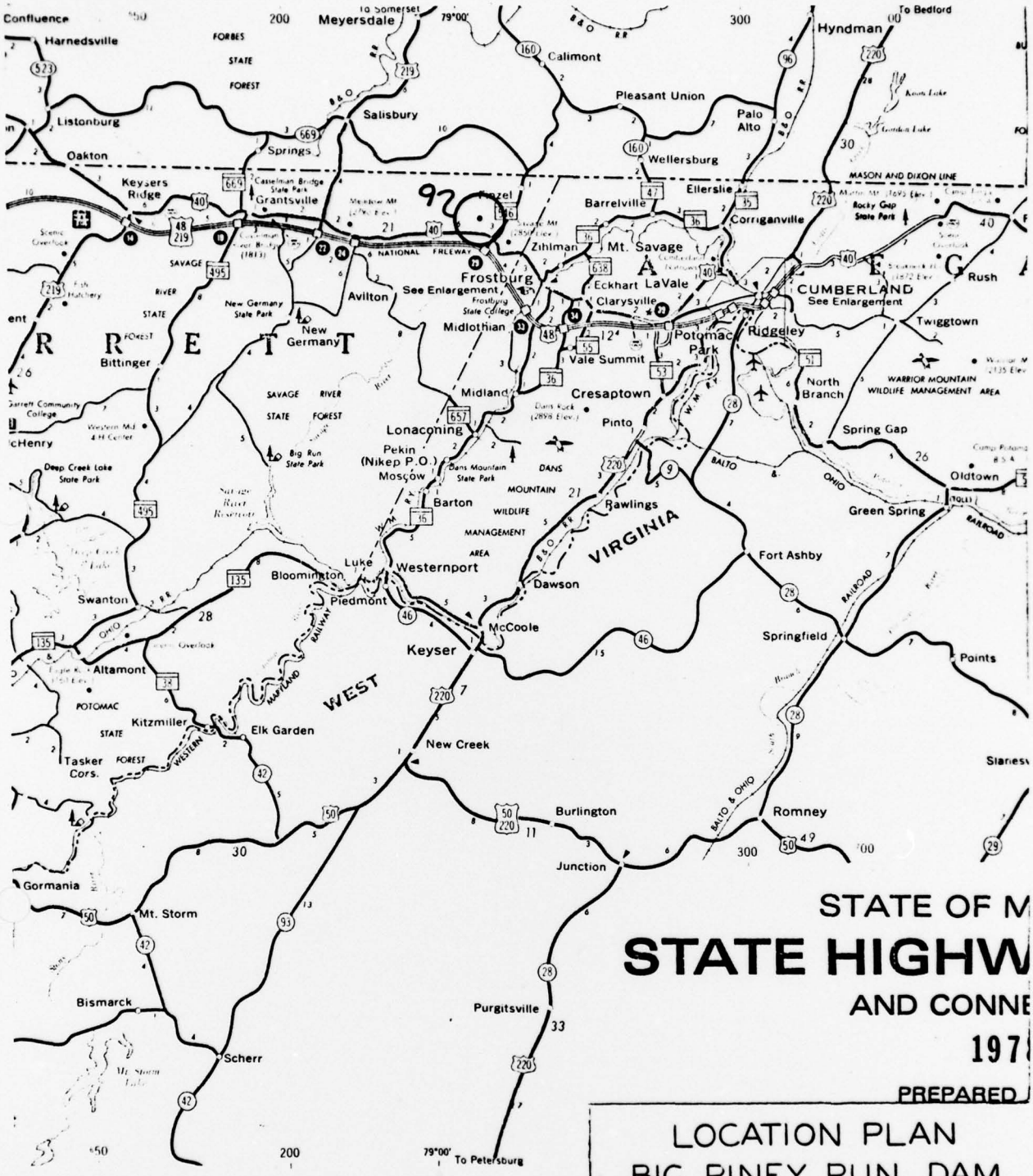
$\therefore$ The boards will collapse when the water depth over a depth of 7" over the flashboards.

However, 2" ϕ STD Pipe is shown as an insert with an inside diameter of 2.067"
Assuming they use 2" ϕ rods
$S = 0.785 r^3 = 0.785$ in^3
$\therefore$ $M_{allow} = 0.785 \times 36 = 28.26$"k
$\therefore$ $h = \frac{28.26 - 4.417}{6.9} = 3.46'$ (maximum)

$\therefore$ If 2" ϕ rods are used then the flashboards will collapse when the depth of water over the spillway crest is 5'-4½".

APPENDIX D

LOCATION, PHOTOGRAPHS & DESIGN DRAWINGS



STATE OF M

STATE HIGHW

AND CONNE

197

PREPARED

LOCATION PLAN
BIG PINEY RUN DAM

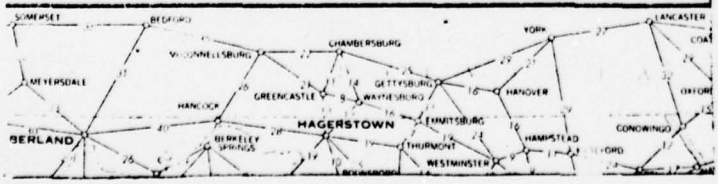
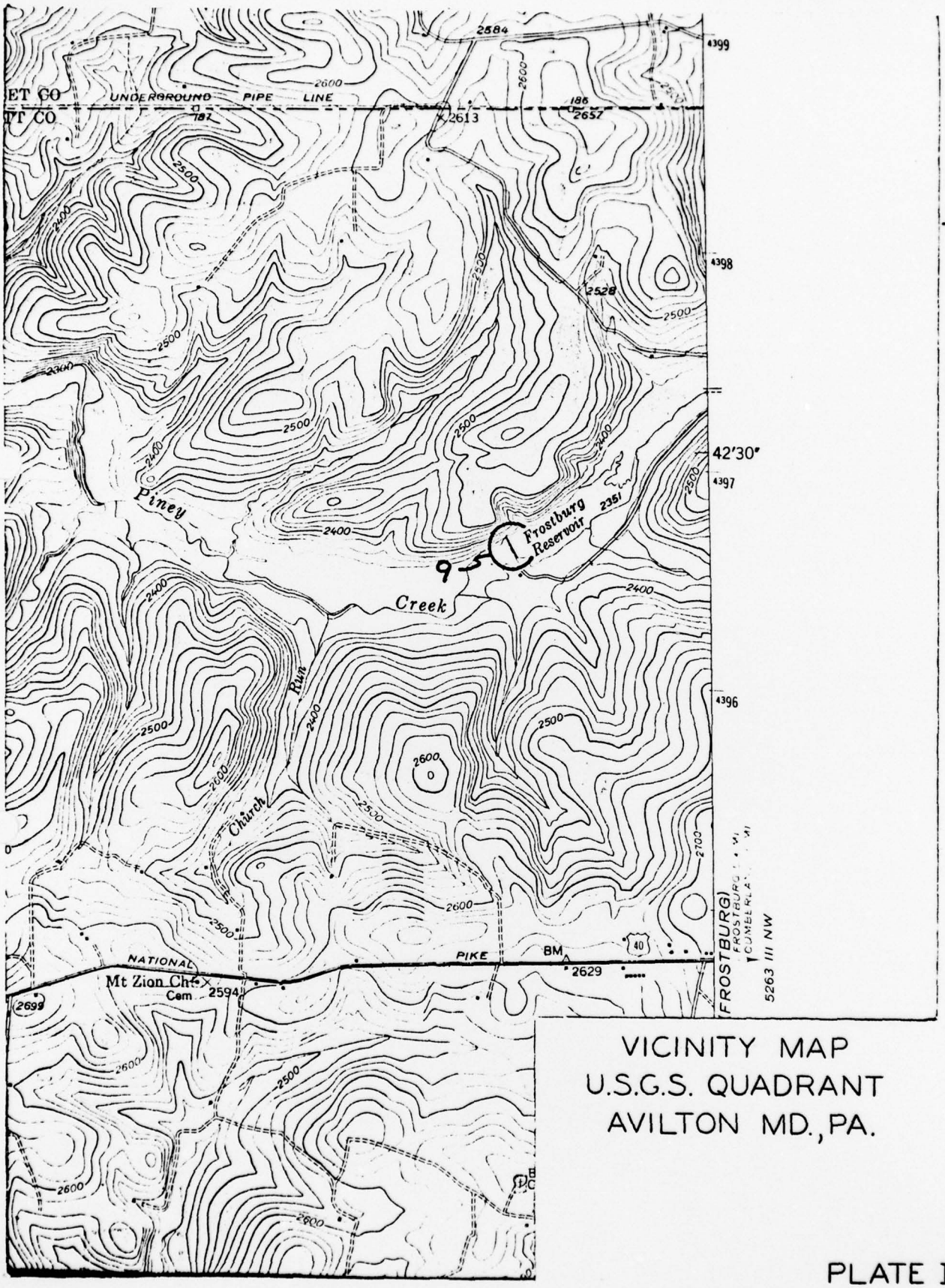
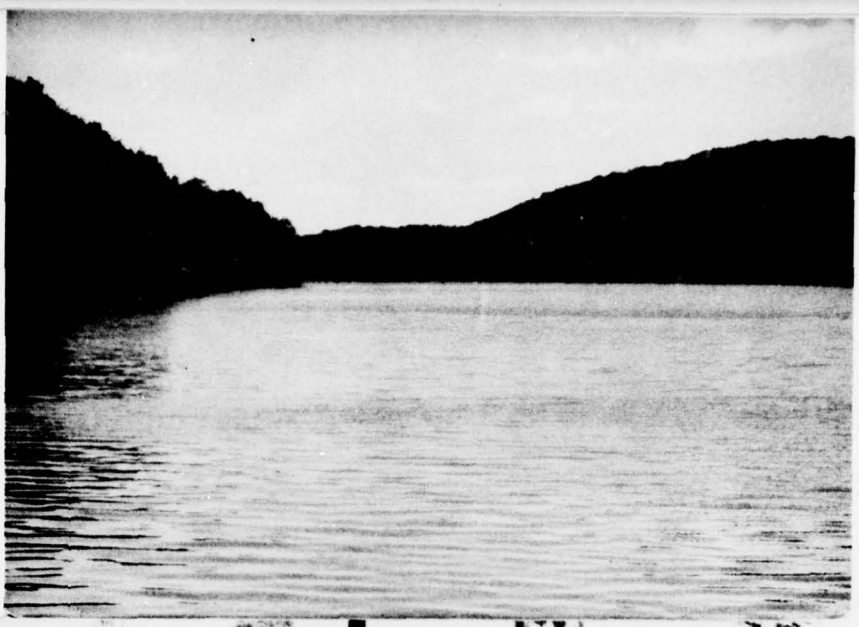


PLATE I



VICINITY MAP
U.S.G.S. QUADRANT
AVILTON MD., PA.

PLATE II

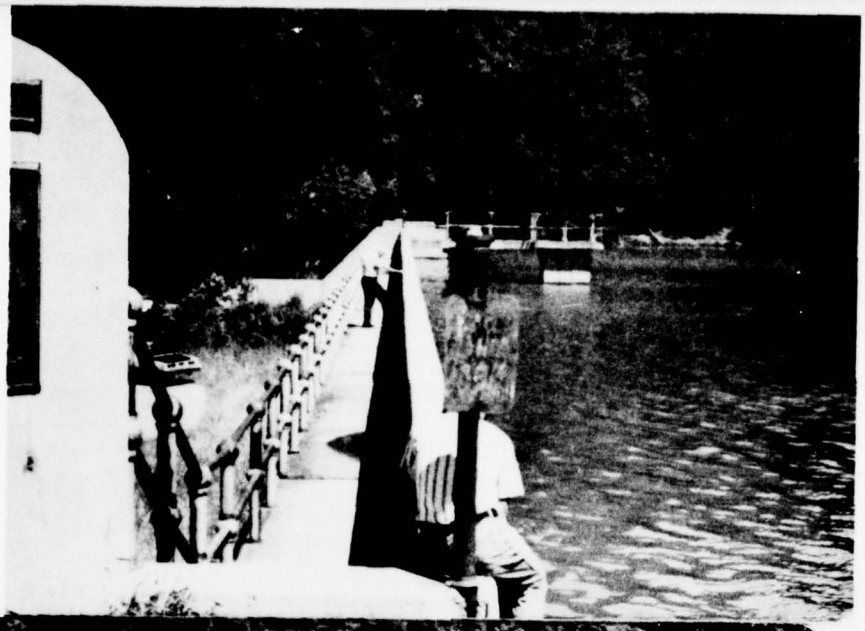


Reservoir

Embankment
Left Abutment
(South)

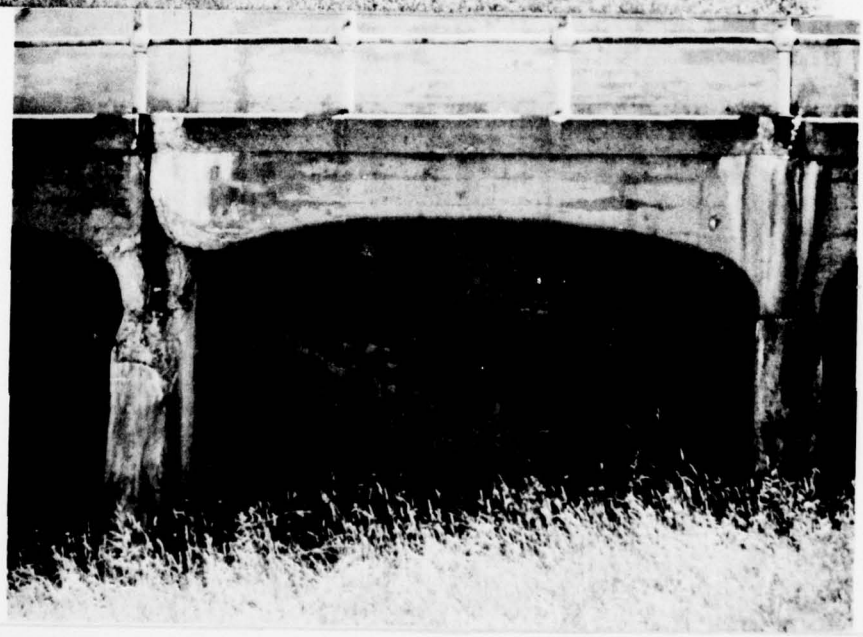
Upstream

PLATE III



Top of Dam

Downstream



Buttress &
Arch Strut

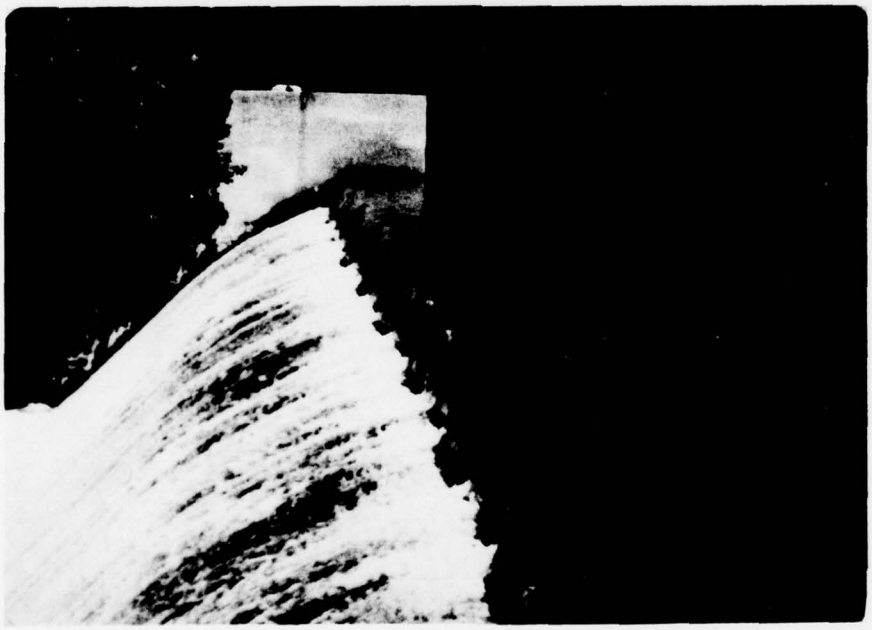
PLATE IV

Parapet at
Light Post

Hole in Slab

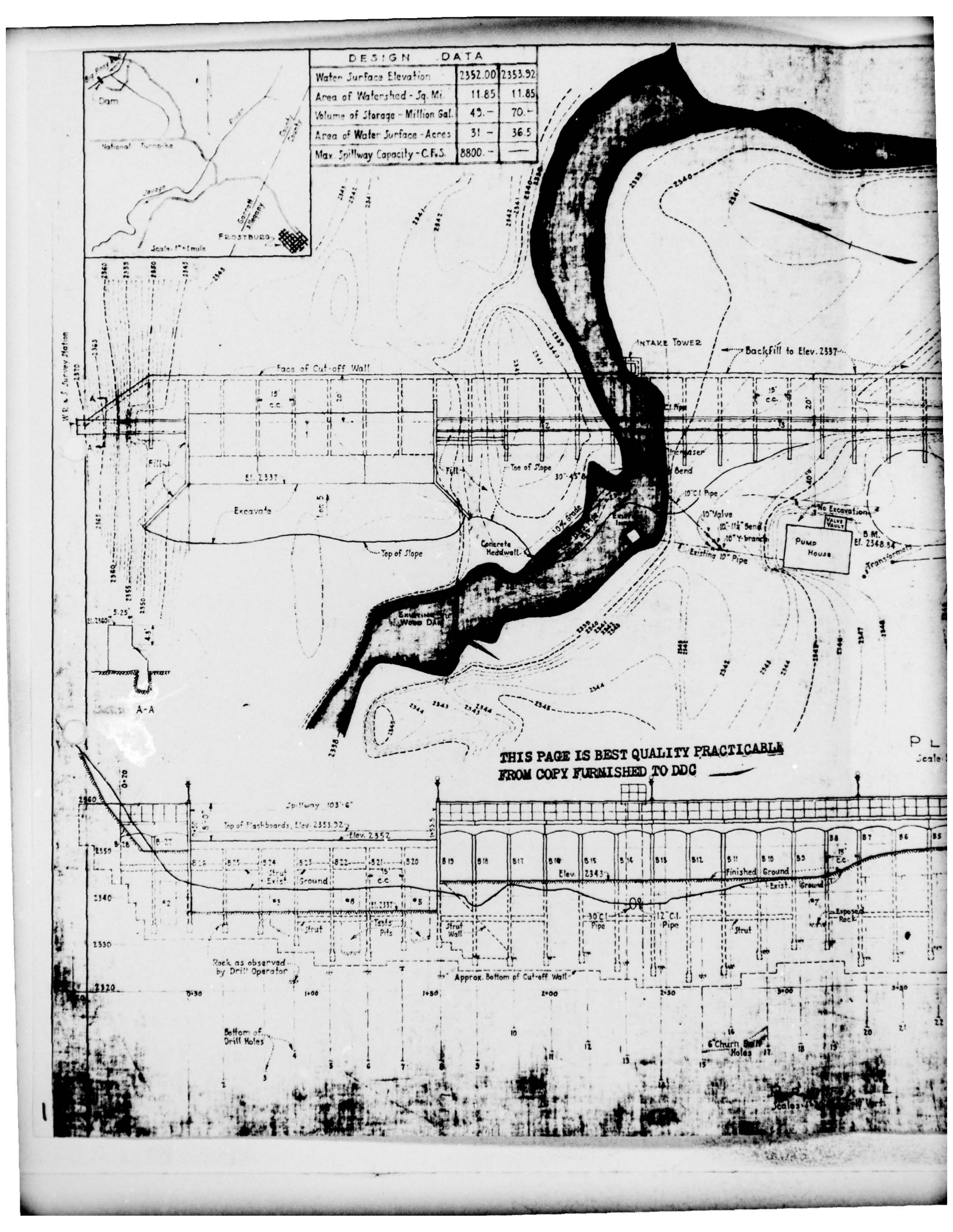
PLATE V

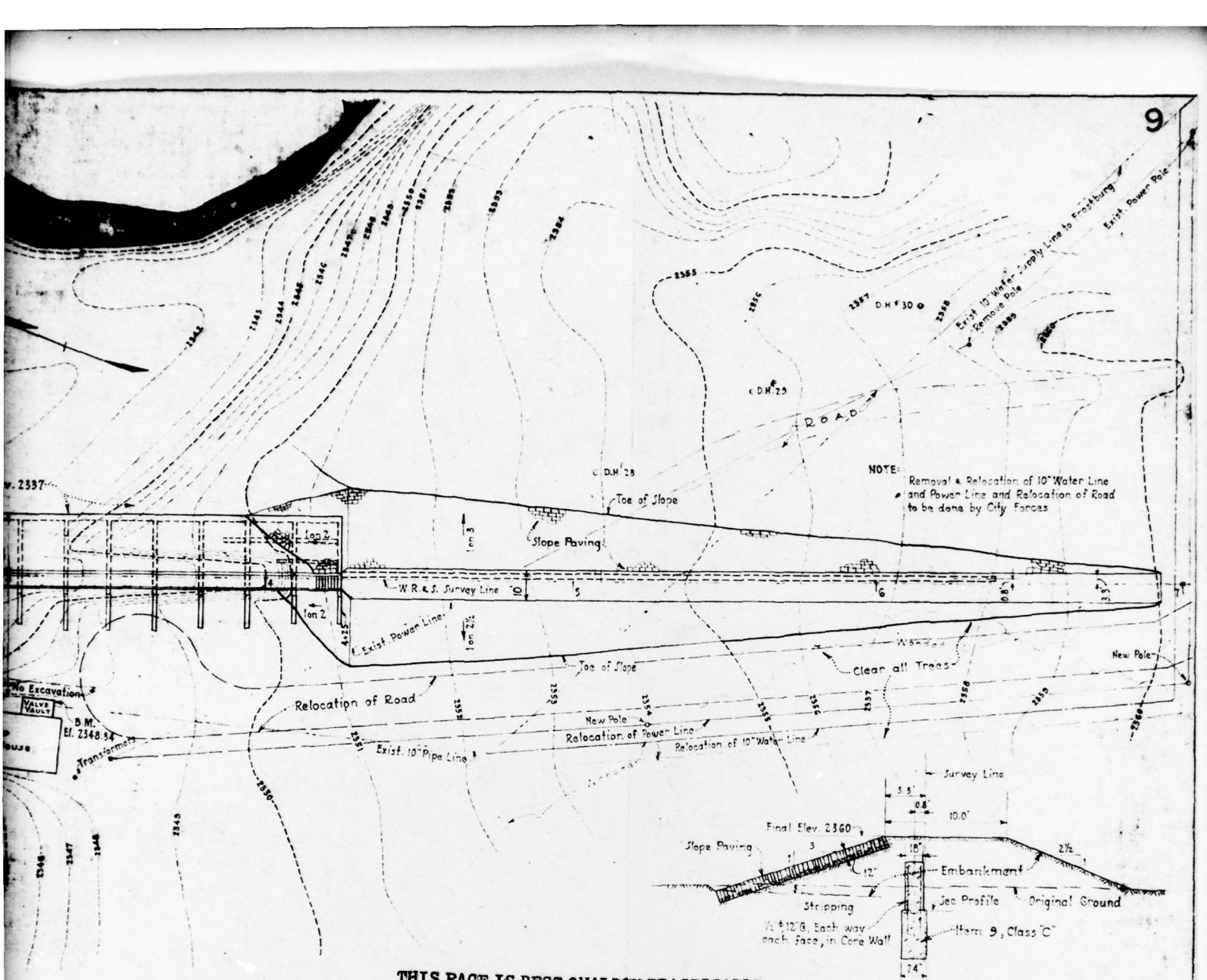
Downstream Channel



Spillway & Flashboards

PLATE VI





PLAN
Scale 1"=20

TYPICAL CROSS SECTION
STA. 5+80±
Scale 1"=5'-0"

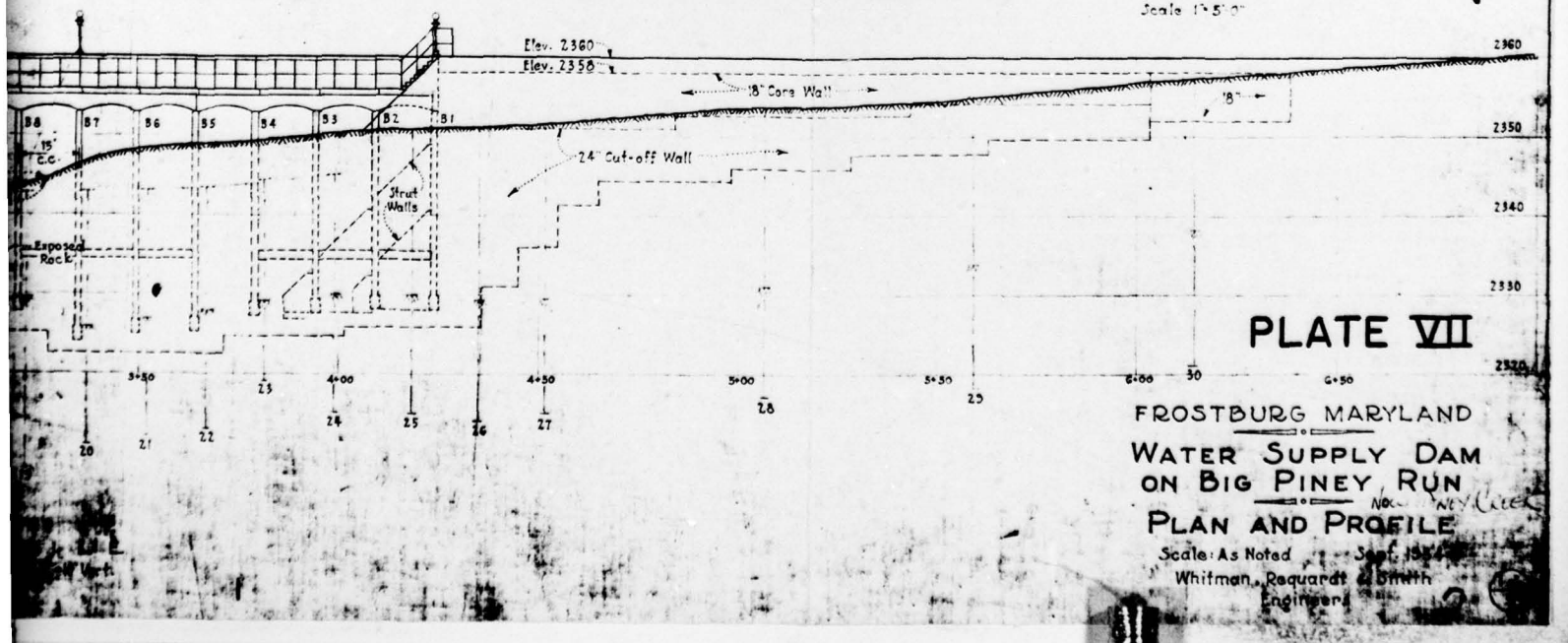


PLATE VII

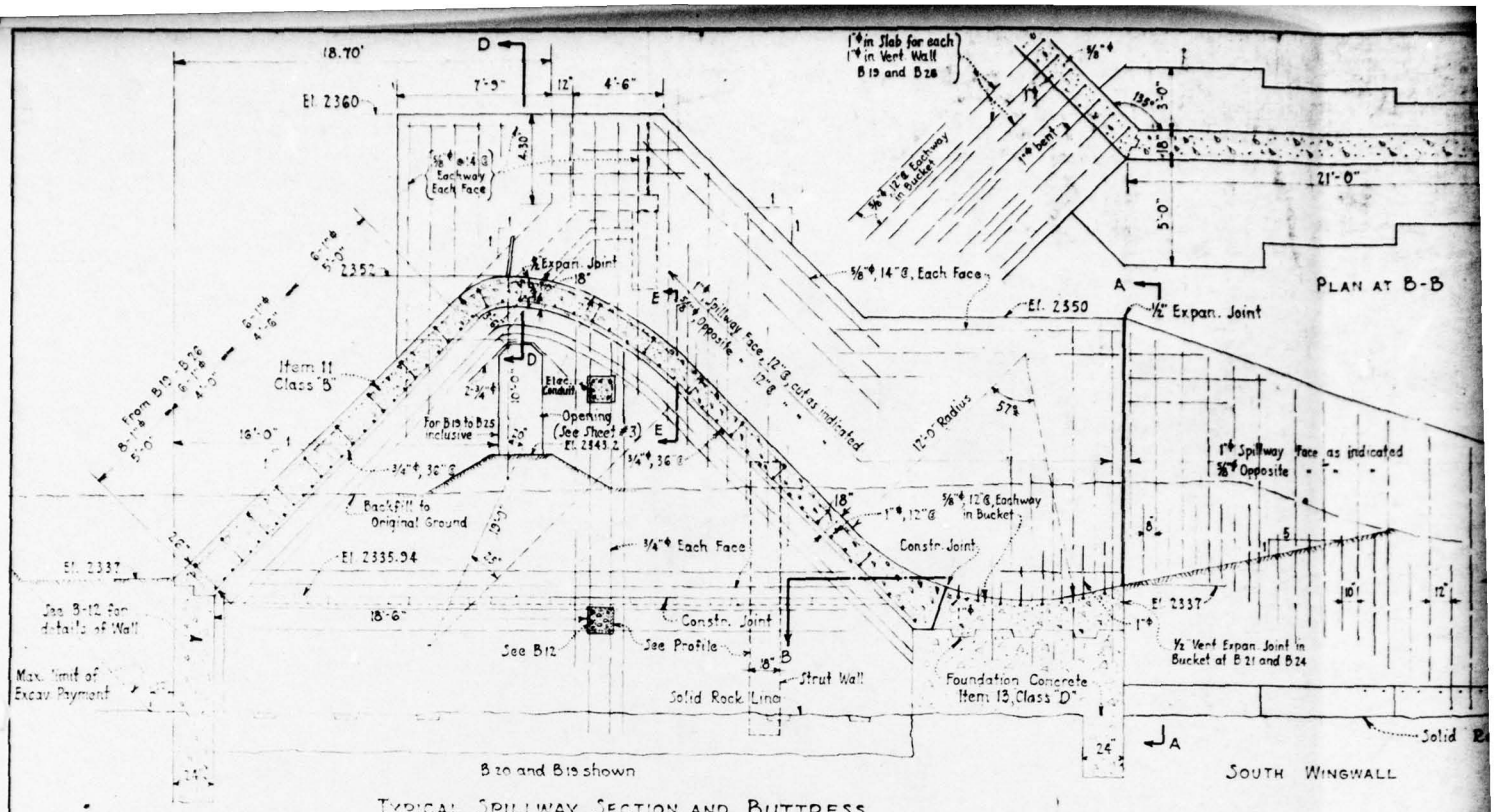
FROSTBURG MARYLAND

WATER SUPPLY DAM
ON BIG PINEY RUN
NO. [illegible] CREEK

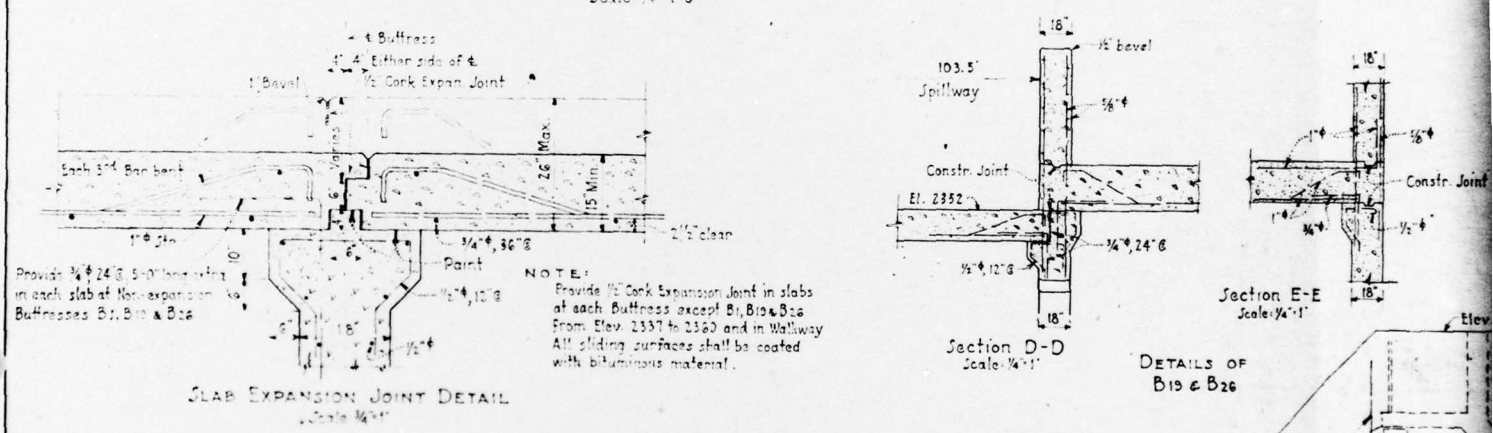
PLAN AND PROFILE

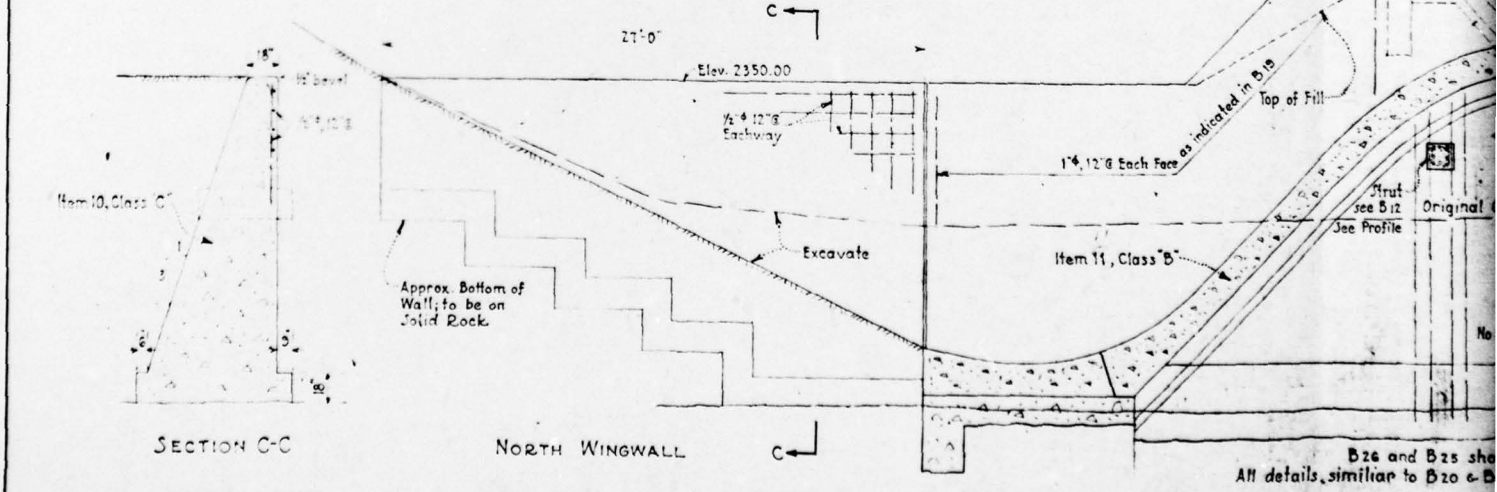
Scale: As Noted Sept. 1954

Whitman, Requardt & Smith
Engineers

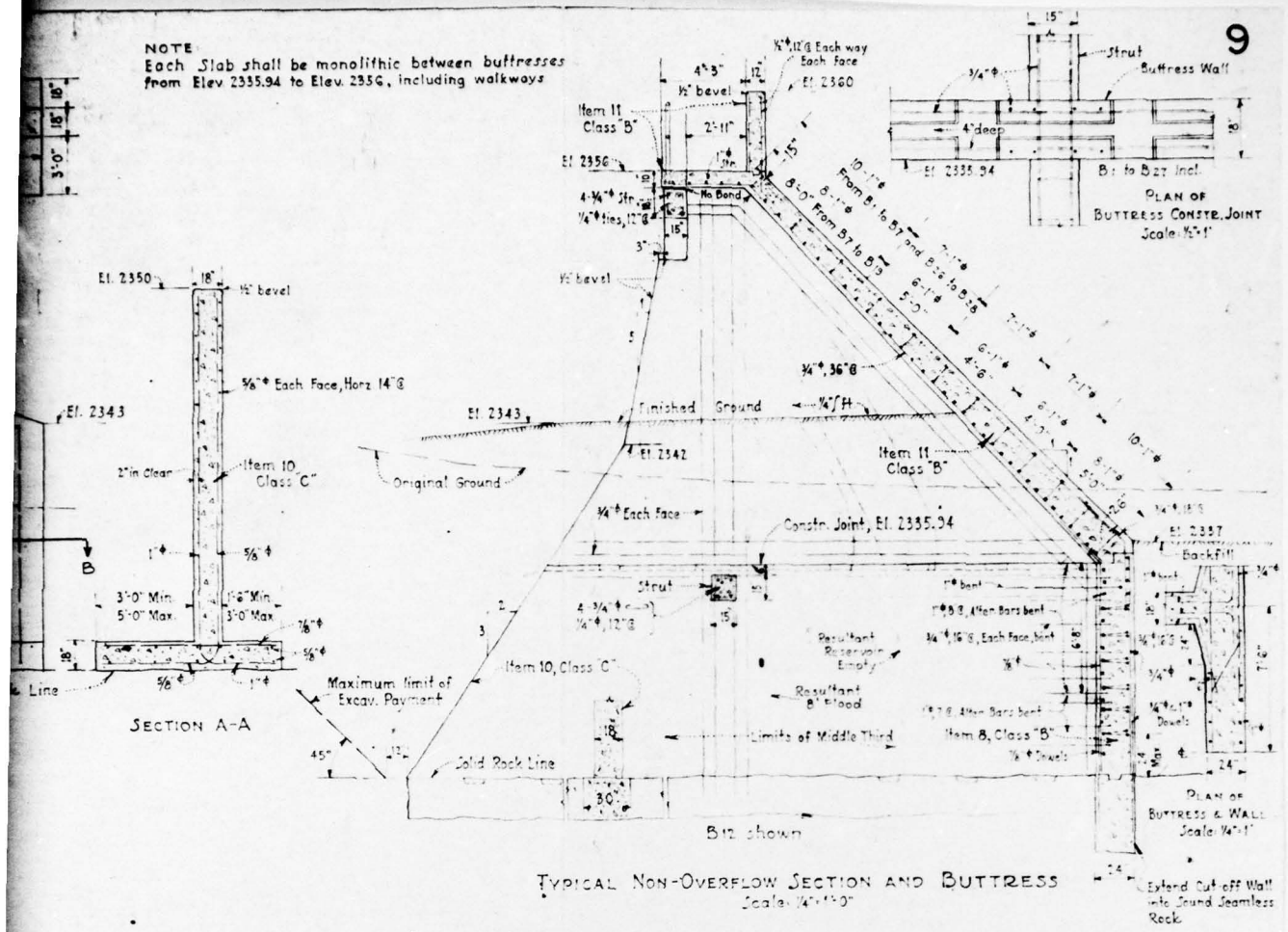


TYPICAL SPILLWAY SECTION AND BUTTRESS
Scale: ¼"=1'-0"





NOTE
Each Slab shall be monolithic between buttresses from Elev 2335.94 to Elev. 2356, including walkways



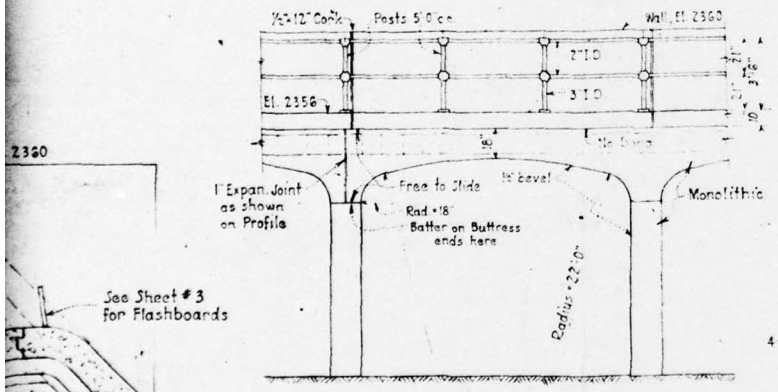
SECTION A-A

TYPICAL NON-OVERFLOW SECTION AND BUTTRESS
Scale: 1/4"=1'-0"

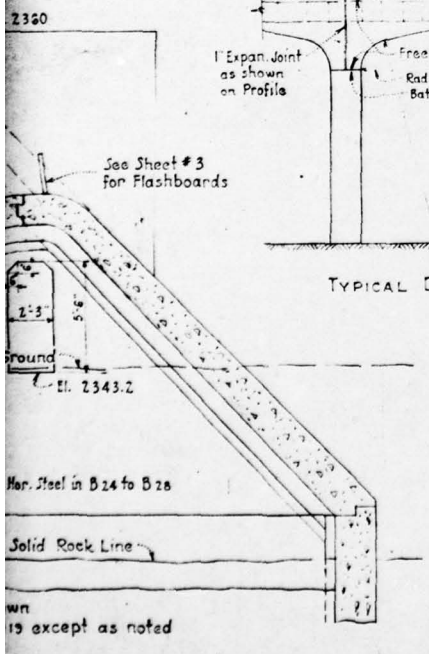
PLAN OF BUTTRESS CONSTR. JOINT
Scale: 1/2"=1'

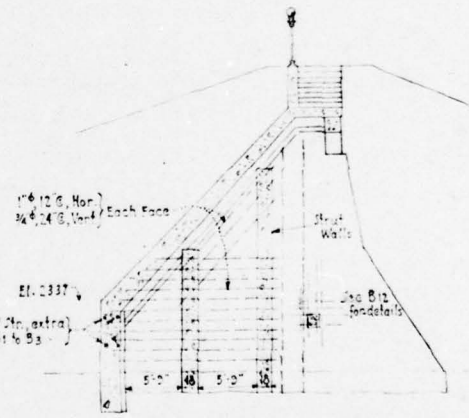
PLAN OF BUTTRESS & WALL
Scale: 1/4"=1'

Extend Cut-off Wall into Sound Seamless Rock



TYPICAL DOWNSTREAM ELEVATION
Scale: 1/4"=1'-0"





END ABUTMENT B-1
Scale: 1/8"=1'-0"

NOTE:
Rubbed finish on concrete surfaces shall be as follows
Upstream face of dam slabs above elev 2350.
Buttress faces to 12" below finished ground surface
Both faces of walkway wall and exposed surfaces of walkway arches and downstream face of walkway slab
Upper face of downstream spillway slab.
Exposed faces on walls at spillway, etc

PLATE VIII

FROSTBURG MARYLAND

WATER SUPPLY DAM ON BIG PINEY RUN

TYPICAL SECTIONS & ELEVATIONS ABUTMENTS & DETAILS

Scale As Noted Sept. 1934

Whitman, Requardt & Smith
Engineers

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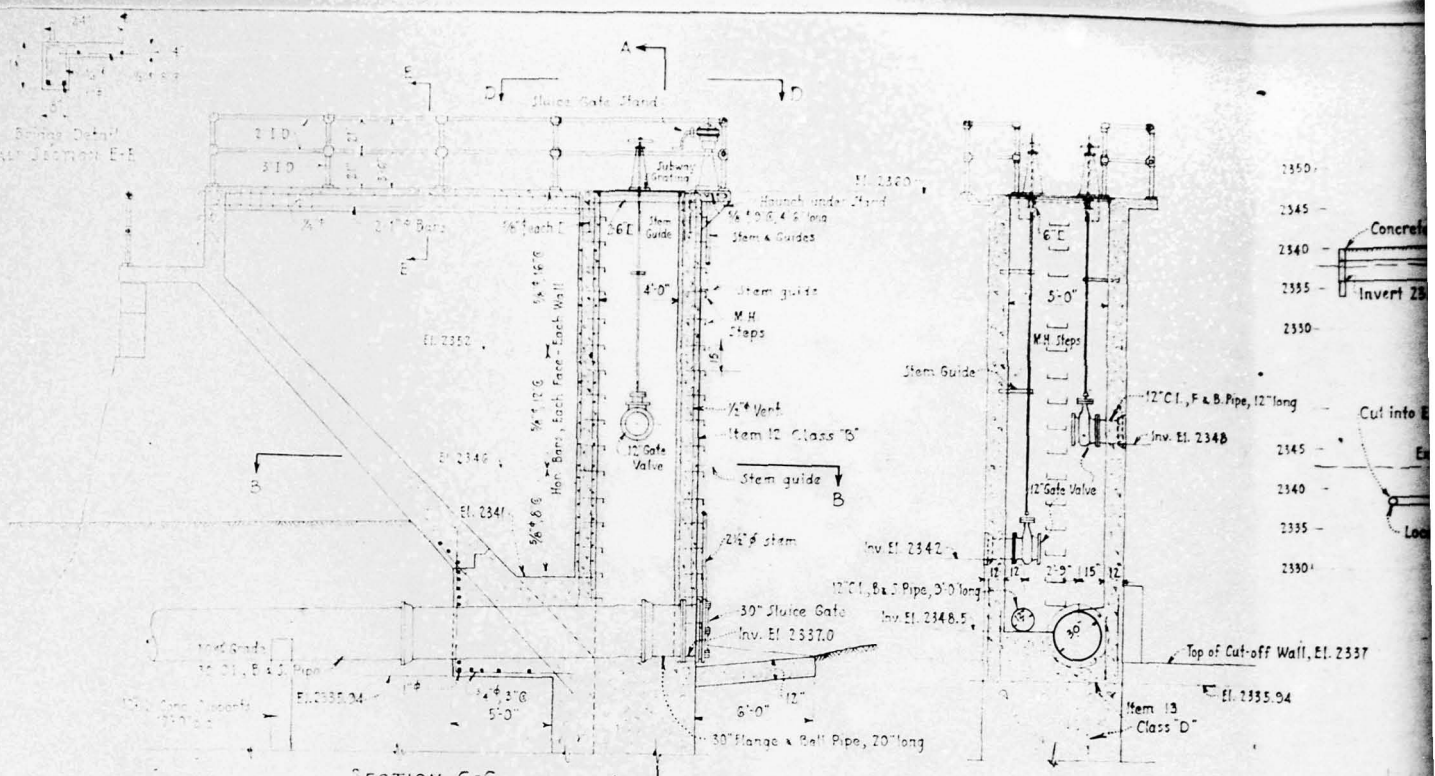

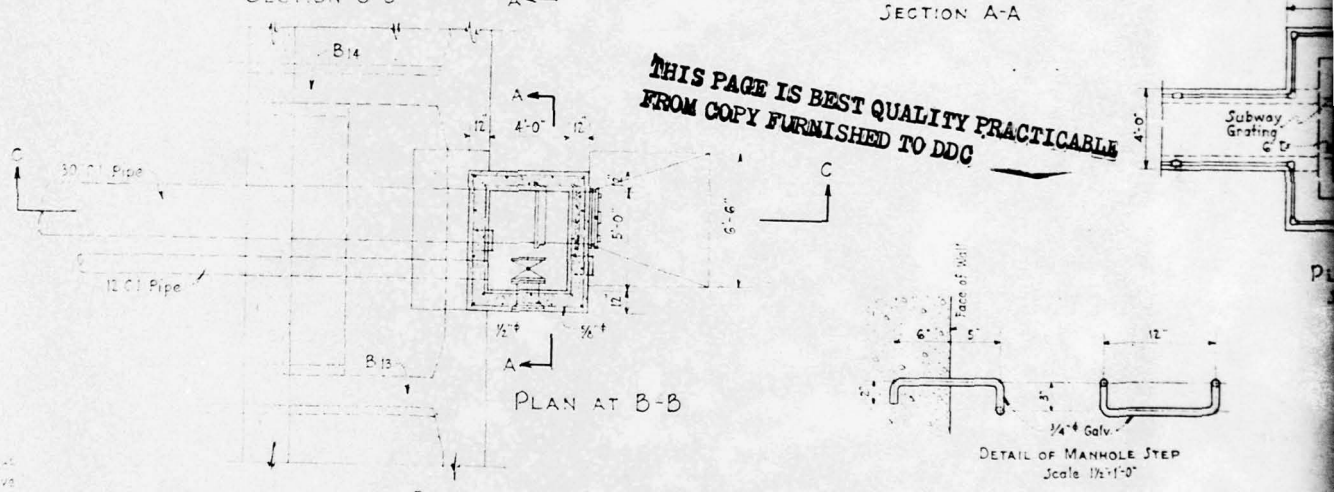

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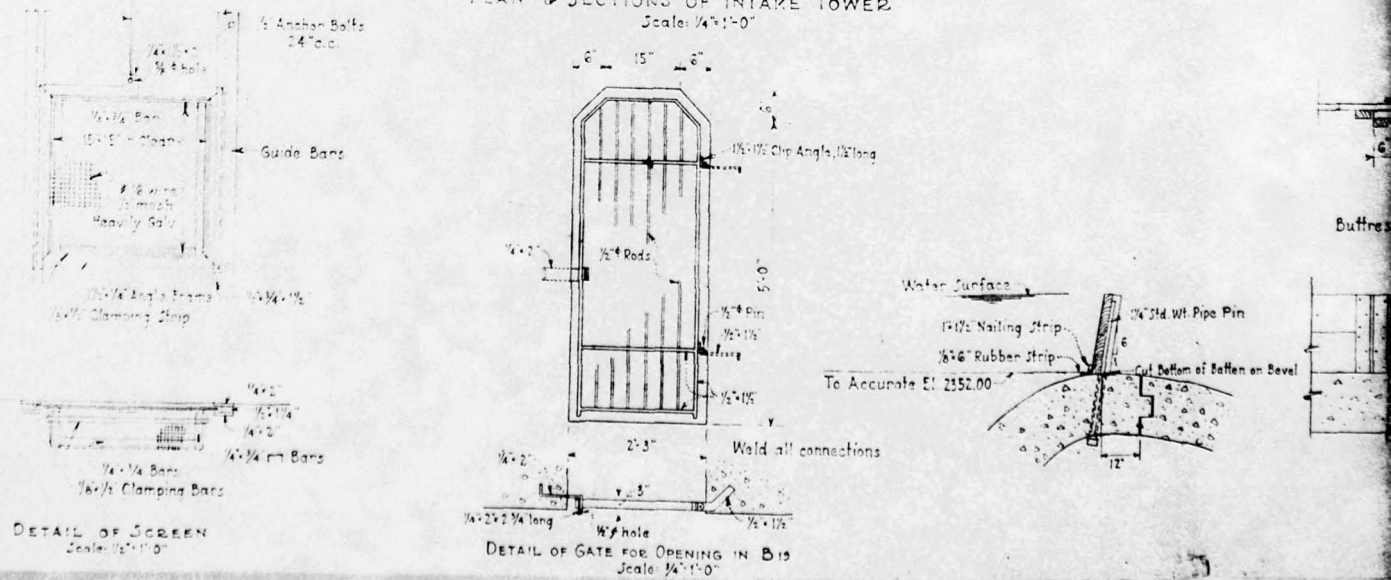
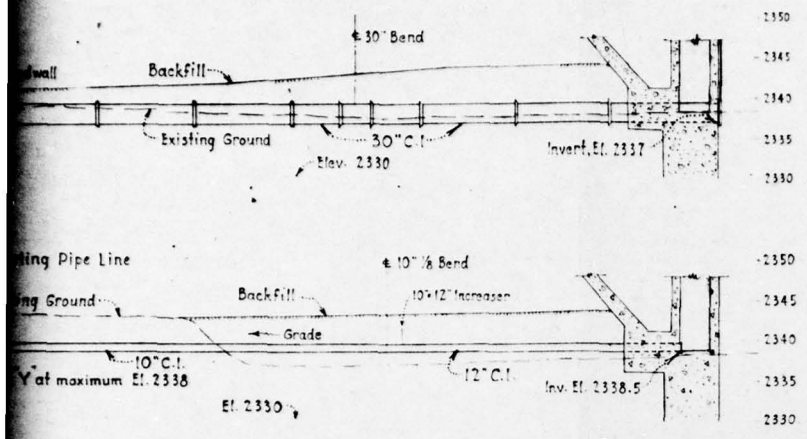
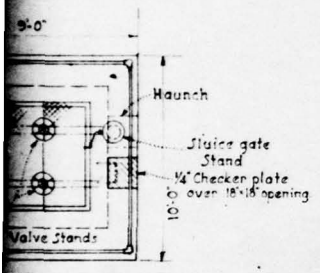
PLAN & SECTIONS OF INTAKE TOWER
Scale: ¼"=1'-0"

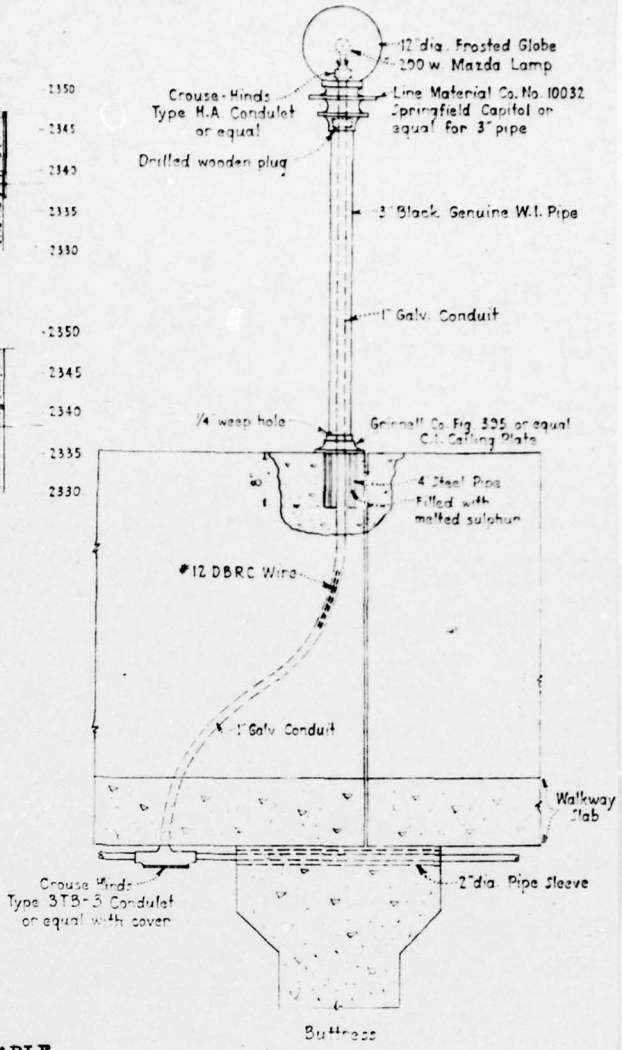




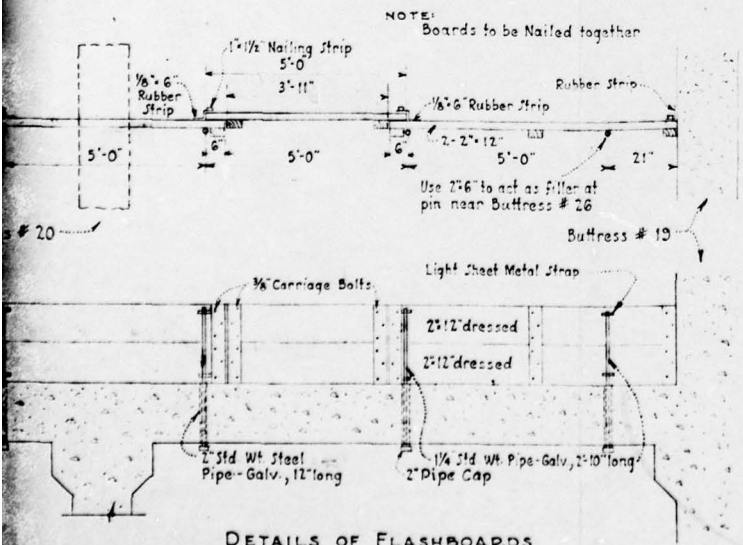
PIPE LINE PROFILES
Scale 1"=10'



AN AT D-D
ale: ¼"=1'-0"



DETAIL OF LAMP STANDARD
Scale 1"=1'0"



DETAILS OF FLASHBOARDS
Scale ½"=1'-0"

PLATE IX

FROSTBURG MARYLAND

WATER SUPPLY DAM ON BIG PINEY RUN

INTAKE TOWER, FLASHBOARDS AND DETAILS

Scale As Noted Sept. 1934

Whitman, Requardt & Smith
Engineers

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